

Parental and Teacher Perspectives on Assistive Technology

A DISSERTATION  
SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL  
OF THE UNIVERSITY OF MINNESOTA  
BY

Darrell Howard Peterson

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF  
DOCTOR OF PHILOSOPHY

Aaron Doering, Adviser  
Charlie Miller, Co-adviser

June, 2017

© Darrell Howard Peterson 2017

## **Acknowledgements**

I would like to express my gratitude to three people, Dr. Simon Hooper, Dr. Aaron Doering, and Dr. Charles Miller. Simon was my first contact with the Learning Technologies program, and I began my program with him as my advisor. Dr. Hooper is an amazing person who generously offered his time, effort, and support, as well as telling me that the work I wanted to do was important. Dr. Doering took over as advisor when Simon left, and he and Dr. Miller provided insight and opportunity for me through the long years of writing my dissertation.

I would also like to thank my committee members, minor advisor Dr. Frank Symons and Dr. Bic Ngo. Your insights were both valuable and sincerely appreciated. I learned a lot from working with both of you both in my coursework and during the dissertation process.

To my mother, Diane Peterson, who has believed in me, supported me, and encouraged me throughout my life, I owe a debt of gratitude that cannot be repaid. Plus, she helped transcribe my interviews. I would not have made it without her help and support.

To my children, Lexie, Alex, Nik, Ellie, Colton, and William, your love, support, understanding, and never ending grief helped keep me going through the whole process.

And finally, I want to thank my beautiful wife, Lara, for not only her support and love, but for putting up with my absences, picking up the pieces when I was too engaged in this work, and for always being there for me. She is the most amazing thing to ever happen to me.

## **Dedication**

To my father, David Peterson, who taught me so much about love, life, and the value of diligence and perseverance.

## **Abstract**

The Individuals with Disabilities in Education Act (IDEA) of 1997 demands that assistive technology be considered for all students with disabilities, yet it is vastly underutilized amongst people with mental retardation (Arc, 1993; Wehmeyer, 1995), learning disabilities (Jeffs, Behrmann, & Bannan-Ritland, 2006; Lewis, 1998; Raskind, Higgins, Slaff, & Shaw, 1998), and infants and toddlers (Dugan, Campbell, & Wilcox, 2006; Wilcox, Guimond, Camhpbell, & Moore, 2006). This underutilization may be depriving these students of important tools that can help them achieve their potential. Why is this happening?

To answer that question, I undertook a Grounded Theory study (Strauss and Corbin, 1990) to obtain a detailed description of the perception parents and special education teachers have of assistive technology for students with cognitive disabilities such as, but not limited to, Autism, ADD/ADHD, or FASD. That perception can have a very real impact on the utilization of assistive technology utilization.

The results of this study have implications for creating a new emphasis on assistive technology in teacher preparation programs and teacher professional development. Beyond teacher preparation and development, the results of this study also suggest a new framework for how schools fund and support assistive technology in their special education programs.

## Table of Contents

Acknowledgements.....	i
Dedication .....	ii
Abstract .....	iii
List of Tables .....	viii
List of Figures .....	ix
Chapter 1: Introduction .....	1
Rational For This Study .....	1
How we got here .....	1
Selecting a Research Method.....	2
Chapter 2: Review of the Literature.....	4
State of Current Assistive Technology Implementation .....	4
Search Procedure .....	6
Legislation.....	7
Technology Related Assistance for Individuals with Disabilities Act of 1988	
.....	8
Americans with Disabilities Act of 1990.....	10
EAHCA and IDEA 1990 .....	12
Technology Related Assistance for Individuals with Disabilities Act	
Amendments of 1994.....	15
The 1998 Amendment to Section 508 .....	18

Assistive Technology Act of 1998.....	19
Assistive Technology Act of 2004.....	21
Individuals with Disabilities Education Act, Amendments of 1997.....	24
Individuals with Disabilities Education Improvement Act 2004.....	25
Perspectives on assistive technology .....	29
Obstacles to the use of assistive technology .....	30
Need for research on the role of parental attitude.....	32
Summary of Literature Review.....	32
Chapter 3: Design of the Study and Research Methods .....	35
Qualitative Approach.....	35
Statement of the Research Questions.....	35
Grounded Theory Method.....	37
Data .....	39
Interviews.....	39
Literature.....	39
District IEP Forms .....	40
Teacher Preparation Requirements from Minnesota Schools.....	40
Sampling .....	40
Instrumentation .....	41
Data analysis procedures.....	41
Trustworthiness of the Data .....	42

Participants of the study.....	47
Participant Profiles.....	51
Ethical considerations .....	54
Preparation and Qualifications for Conducting This Research.....	54
Chapter Four – Findings and Interpretations .....	56
Introduction.....	56
Major Findings of the Study .....	56
Parental Findings .....	56
Teacher Findings.....	59
Research Question Results.....	95
Conclusion .....	100
Chapter Five – Discussion and recommendations .....	101
A Theory of Parental and Teacher Perspectives on assistive technology? .....	101
Introduction.....	101
Explanation .....	102
Discussion .....	103
Limitations of This Study .....	104
Implications for Research .....	104
Implications for Practice .....	105
References .....	113
Appendix A. interview Protocol: Parents .....	126



Appendix B. Interview Protocol: Special Education Teachers.....	128
Appendix C. Assistive Technology Legislation .....	130

## List of Tables

Table 1 .....	48
Table 2 .....	49
Table 3 .....	50
Table 4 .....	106

## **List of Figures**

Figure 1. Legislative Timeline.....	29
-------------------------------------	----

## CHAPTER 1: INTRODUCTION

### Rational For This Study

#### *How we got here*

The seeds of this project began when I attended the first Individual Education Plan (IEP) meeting for my son, who has FASD. While we were going through the IEP process, I was earning my master's degree in Learning Technology. I began exploring a large range of research that suggested the wonderful possibilities of assistive technology for students with all types of disabilities. This exploration led me to envision a myriad of ways that I could use technology to help my son overcome his disability. And then we walked into the IEP meeting. We talked about several adaptations that could be made to the class room to help him cope. We discussed the direct and indirect services that he would need to address the issues brought about by his disability. Yet we never once discussed the use of assistive technology for him. I examined his IEP form from the school. The only mention of assistive technology was a small checkbox that indicated that assistive technology had been considered. This spurred further research on my part to discover whether assistive technology was required to be considered as part of a child's IEP. According to the Individuals with Disabilities Education Act Amendments of 1997 (IDEA), assistive technology must be considered for every student with an IEP (Individuals with Disabilities Education Act Amendments of 1997, 1997). Yet we had not even discussed assistive technology. I wondered why. I started another round of research to see how often assistive technology was used on IEPs.

While finding no hard statistics, I began finding research suggesting that assistive technology was underutilized, especially amongst certain populations, including people with mental retardation (Arc, 1993; Wehmeyer, 1995), learning disabilities (Jeffs, Behrmann, & Bannan-Ritland, 2006; Lewis, 1998; Raskind, Higgins, Slaff, & Shaw, 1998), and infants and toddlers (Dugan, Campbell, & Wilcox, 2006; Wilcox, Guimond, Camhpbell, & Moore, 2006). Many researchers, myself included, find this alarming given the potential benefits that research on technology (Campbell, 2004; Campbell, McGregor, & Nacik, 1994; Flippo, Inge, & Barcus, 1995; J. Langone, Malone, & Kinsley, 1999; Mistrett, 2004) has shown for these populations . It also raises concerns regarding the federal mandate by the Individuals with Disabilities Education Act (IDEA) of 1997 that assistive technology be considered for all students with disabilities.

### *Selecting a Research Method*

I decided to undertake this research in order to better understand the concept of assistive technology adoption. More specifically, I wanted to develop a theory about the conditions that influence the adoption of assistive technology. I decided to use a grounded theory approach to studying this phenomenon, because, as Strauss and Corbin state: “the main purpose of using the grounded theory method is to develop theory” (Straus and Corbin, 1998. p.37). Straus and Corbin state further that a “grounded theory is one that is inductively derived from the stuff of the phenomenon it represents. That is, it is discovered, developed, and provisionally verified through systematic data collection and analysis of data pertaining to that phenomenon. Therefore, data collection, analysis, and theory stand in reciprocal relationship with each other” (Straus and Corbin, 1998. p.

23). I chose to begin with an area of study (assistive technology adoption) and allow relevant details to emerge in order to better understand the assistive technology adoption process. This began with parent interviews, a review of the literature as both secondary source of data and supplementary validation of what parents were saying, followed by expanding subjects to teachers, followed by further literature review, followed finally by reviews of teacher education programs.

This study attempts to examine two critical pieces necessary for the successful adoption of assistive technology - parental attitudes and understanding of assistive technology, and the special education teachers' attitudes and understanding of assistive technology.

## CHAPTER 2: REVIEW OF THE LITERATURE

### State of Current Assistive Technology Implementation

Parental involvement is essential for the successful adoption of assistive technology by students with disabilities (Jeffs et al., 2006; Jeffs & Morrison, 2005; Lahm & Sizemore, 2002; Todis & Walker, 1993). Todis (1996) identified an initial resistance on the part of parents to adopt assistive technology (assistive technology). In their qualitative study, Huting, Johanson, and Stoneburner (1996) explored barriers to effective assistive technology implementation. One theme that emerged was parental ability and attitude toward the implementation of assistive technology. Parent's expressed concern about the availability of training, their comfort and ability with computers and computer technology, unfamiliarity with solving hardware and software problems, difficulty obtaining software, and a lack of collaboration between parents and school staff. The area of parental attitude and difficulty are of particular interest because parents are often their child's strongest advocate. Lode (1992), identified lack of support and family involvement as a major reason for abandoning assistive technology equipment.

As defined by the Individuals with Disabilities Education Act Amendments of 1997 (IDEA), assistive technology is "any item, piece of equipment, or product system ... that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" ("Individuals with Disabilities Education Act Amendments of 1997," 1997). IDEA also stipulates that assistive technology must be considered for every student with an Individual Education Plan (IEP) ("Individuals with Disabilities Education Act Amendments of 1997," 1997). An IEP is a document that details the special education

services for a student with disabilities, including any modifications that are required in the regular classroom and any special programs or services. While this is an important step in considering technology as a tool to help those with special educational needs, there is little in the law to suggest exactly how this mandate should be met. This has led to a wide range of policies and procedures regarding the needs assessment and implementation of assistive technology (Blackhurst & Edyburn, 2000). This range of policies and procedures varies from state to state and even school district to school district. To further complicate the picture, while researchers such as Mechling, Langone, Blackhurst, Edyburn, Huting, Wissick, and others have conducted numerous studies (Kevin M. Ayres & Langone, 2002; Kevin Michael Ayres & Langone, 2005; Blackhurst, 2005; Edyburn, 2003; Huting, Robinsosn, Schneider, & Johanson, 2002; John Langone, 1998; John Langone, Clees, Rieber, & Matzko, 2003; John Langone & et al., 1996; J. Langone et al., 1999; John Langone & Mechling, 2000; John Langone, Shade, Clees, & Day, 1999; Mechling & Gast, 2003; Mechling, Gast, & Langone, 2002; Nikopoulos & Keenan, 2004; C. Wissick, 2002; C. A. Wissick, Gardner, & Langone, 1999) examining the efficacy of specific technologies for students with various types of disabilities, according to Alper and Raharinirina (2006), “[i]t has been 18 years since the passage of the Tech Act, yet many of the recommendations and requirements embedded in this legislation are not being addressed in the literature” (Alper & Raharinirina, 2006, p. 53). Blackhurst (1997) notes that the pedagogy surrounding assistive technology is relatively new to the field of special education. Watts, O’Brian, and Wojcik (2004) identify four major models for assistive technology consideration and assessment. None of these



models, however, deals directly with the communication between special education professionals, and the parents of students with disabilities.

### Search Procedure

In order to locate relevant articles, the following search procedures were used in the order listed. First, an electronic search using the Educational Resource Information Center (ERIC) database was conducted using the following key words, either alone or in various combinations: assistive technology (assistive technology), special education, barriers, benefits, and parental attitudes. To ensure that the most recent relative articles had been reviewed, a hand review of the most recent issues (2004 – present) of the Journal of Special Education Technology was conducted, Examining articles whose abstracts mentioned any of the above key words. Finally, a review of the reference sections of the articles obtained in the above methods was conducted. A total of 22 articles that met the selection criteria were found. Of those, 8 dealt with the benefits of assistive technology, either to specific populations, or in general, 7 dealt in some way with barriers relating to parental involvement or parental attitudes, or exploring assistive technology from a parental perspective, and the remaining 7 dealt with factors other than parents/parental attitudes, such as teacher training or attitude.

This review of the literature also necessitated a review of the relevant legislation and the literature commenting on its effects on special education. I first began with this review of legislation, followed by a review of the literature related to varying perspectives on assistive technology, and finally reviewed the literature related to obstacles and/or barriers related to assistive technology.

## Legislation

The legal rights of children with disabilities has been greatly improved by legislation enacted in the last 25 years. This legislation has also stimulated the growth of technology use in special education. "This stimulation has been in the form of federal laws and regulations that have included technology mandates and funding to support a wide variety of technology research and development, training, and service activities" (Blackhurst, 2005a, p. 3).

Assistive technology was introduced into federal legislation to give students with disabilities increased access to the general education curriculum (Edybum, 2000a).

Marino, Marino, and Shaw (2006) outlined four major pieces of legislation they considered pertinent to assistive technology: The Technology Related Assistance for Individuals with Disabilities Act of 1988, The Americans with Disabilities Act of 1990, The 1998 Amendment to Section 508 of the Rehabilitation Act, and The Assistive Technology Act of 1998. The following is a review of the pertinent literature as identified by Marino et al. (2006). This review also examines The Technology-Related Assistance for Individuals With Disabilities Act Amendments of 1994, the Education for All Handicapped Children Act, the Individuals with Disabilities Act Amendments of 1997, and the Individuals with Disabilities Education Improvement Act of 2004, which required assistive technology to be considered in the educational programs of students with disabilities.

*Technology Related Assistance for Individuals with Disabilities Act of 1988*

Assistive technology was first introduced into federal law in The Technology-Related Assistance for Individuals with Disabilities Act of 1988, the Tech Act. Assistive technology is now incorporated into every piece of federal legislation for persons with disabilities. This act has been touted as one of the most influential and potentially beneficial laws which "supports the development of programs that will ensure access to appropriate assistive technology devices and services for individuals with disabilities and their families" (Bryant et al., 1998, p. 55). This act was "the first substantive federal legislation dedicated solely to AT" (Marino et al., 2006, p. 19).

The Tech Act was passed by Congress "to provide funding for the development of consumer information and training programs for individuals with disabilities. The Tech Act outlined two types of assistive technology- devices and services" (Dyal, Carpenter, & Wright, 2009, p. 557). The Tech Act was "designed to enhance the availability and quality of assistive technology (AT) devices and services to all individuals and their families throughout the United States" (Behrmann & Jerome, 2002).

"The term 'assistive technology device' means any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" [29 U.S.C. § 2202(1)]. The Tech Act includes the definition of an assistive technology service:

- (4) Assistive technology service.--The term "assistive technology service" means any service that directly assists an individual with a disability in the

selection, acquisition, or use of an assistive technology device. Such term includes-

- (A) the evaluation of the assistive technology needs of an individual with a disability, including a functional evaluation of the impact of the provision of appropriate assistive technology and appropriate services to the individual in the customary environment of the individual;
- (B) services consisting of purchasing, leasing, or otherwise providing for the acquisition of assistive technology devices by individuals with disabilities;
- (C) services consisting of selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing assistive technology devices;
- (D) coordination and use of necessary therapies, interventions, or services with assistive technology devices, such as therapies, interventions, or services associated with education and rehabilitation plans and programs;
- (E) training or technical assistance for an individual with disabilities, or, where appropriate, the family members, guardians, advocates, or authorized representatives of such an individual; and (F) training or technical assistance for professionals (including individuals providing education and rehabilitation services), employers, or other individuals who provide services to employ or are otherwise substantially involved in the major life functions of individuals with disabilities. [29 U.S.C. § 2202(3)(2)]

However, this act did not establish any standards for the delivery of assistive technology services or standards to the providers of these services. The Tech Act provided federal funds to states to develop training and delivery systems for assistive technology devices and services. These funds were in the form of grants to develop consumer information and training programs to meet the needs of students with disabilities. Each state was required to develop a plan including technology- related services for students with disabilities and provide definitions to delineate assistive technology devices and services.

Bryant and Seay (1998) recognized the significance of the Tech Act. "Congress acknowledged AT's potential for assisting persons with disabilities to access the 'American dream' when it passed into law in 1988 the Technology-Related Assistance for Individuals with Disabilities Act" (p. 4).

#### *Americans with Disabilities Act of 1990*

The Americans with Disabilities Act (ADA) was signed into law in 1990 and its intent was to "provide clear, strong, consistent, enforceable standards addressing discrimination against individuals with disabilities" (Americans With Disabilities Act, 1990). Prior to ADA, any entity doing business with the federal government was required to meet the accessibility standards specified by previously enacted laws. The ADA extended "accommodations for individuals with disabilities beyond the federal government to the public and private sector" (Mondak, 2000, p. 45). These accommodations, as defined by Mondak, were "made to allow the individual to access needed facilities; equipment; technology such as computers, telecommunications,

audiovisual equipment, and programs; or other communication systems in the office that are the same as those used by individuals without a disability" (p. 45). Assistive technology devices and services are compatible with Mondak's definition of an accommodation and can be critical in achieving provisions of ADA by promoting access.

The ADA extended "full civil rights and equal opportunities to people with disabilities in both the public and private sectors" (Bailey, 2000, p. 2). The ADA, a civil rights statute, prohibited "discrimination on the basis of a physical or mental disability in employment, public services, public accommodations, and telecommunications"(p. 2). ADA's message maintained that intentional segregation and exclusion of people with disabilities would no longer be accepted (Day & Edwards, 1996). The ADA did not specifically address assistive technology, but it did extend civil rights protections to students with disabilities.

Marino et al. (2006) believed the ADA significantly impacted assistive technology consideration for students with disabilities. ADA stipulated that students with disabilities "be given equal access to public education, employment, transportation, recreation, and health care" (p. 19). Public Accommodations as outlined by ADA extended to places of education including public schools, elementary and secondary private schools, and day care programs. Practically every school district and post-secondary school in the United States is subject to ADA and Section 504 of the Rehabilitation Act of 1975 (Section 504) requirements (Smith, 2001). Section 504 applies to "entities that receive federal funds and the ADA apply to virtually every entity in the

country except churches and private clubs. Schools that receive federal funds must comply with both Section 504 and the ADA" (p. 343).

Though the ADA required right of entry to education settings, access to materials inside those settings also proved challenging. An individual's access to educational content within a classroom setting without barriers of accessibility was one of the system changes mandated in The Technology-Related Assistance for Individuals with Disabilities Act Amendments of 1994.

### *EAHCA and IDEA 1990*

Public Law 94-142, the Education for All Handicapped Children Act (EAHCA) was amended and the name changed to Individuals with Disabilities Education Act [IDEA], (1990; Etscheidt & Bartlett, 1999). The primary purpose of both statutes is to "ensure that a free and appropriate public education (FAPE) is provided to children with disabilities who have been determined to need specially designed instruction" (Reed and Bowser, 2005, p. 61). A Free Appropriate Public Education (FAPE) is what all children in the United States are entitled to under IDEA.

IDEA 1990 "created a detailed set of guidelines to ensure an appropriate education in the least restrictive setting" (Yell & Katsiyannis, 2004, p. 28) for students with disabilities. In order to be provided with a free appropriate public education, children with disabilities may be placed in several different types of educational settings. The least restrictive of these settings is the general education environment because this is the "placement in which there is the greatest measure of opportunity for proximity and communication with the ordinary flow of students in schools" (p. 30).

IDEA (1990) defined "assistive technology for the first time, using a broad interpretation consistent with previous legislation" (Parette & VanBiervliet, 1991). This

definition, which has been retained in IDEA is "any item, piece of equipment, or product system, whether acquired commercially or off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of children with disabilities"(20 U.S.C. §1401(a)(25); 34 C.F.R. §300.5). IDEA 1990 defined an assistive technology service as:

Any service that directly assists an individual with a disability in the selection, acquisition, or use of an assistive technology device. Such term includes - - (A) the evaluation of the needs of an individual with a disability, including a functional evaluation of the individual in the individual's customary environment (20 U.S.C. § 1401(2)(A))

Including these definitions in IDEA increased access to assistive technology devices and services for children with disabilities and reinforced the provision of assistive technology as a means for a free and appropriate public education (Bailey et al., 2005).

Two of the general principles of IDEA 1990 were Free Appropriate Public Education (FAPE) and Least Restrictive Environment (LRE).

Free appropriate public education, or FAPE, means special education and related services that-- (a) Are provided at public expense, under public supervision and direction, and without charge; (b) Meet the standards of the SEA, including the requirements of this part; (c) Include an appropriate preschool, elementary school, or secondary school education in the State involved; and (d) Are provided in



conformity with an individualized education program (IEP) that meets the requirements of Sec. 300.320 through 300.324. (34 C.F.R. § 300.17)

(Authority: 20 U.S.C. 1401(9))

Least Restrictive Environment, or LRE, requirements are

Except as provided in Sec. 300.324(d)(2) (regarding children with disabilities in adult prisons), the State must have in effect policies and procedures to ensure that public agencies in the State meet the LRE -requirements of this section and Sec. Sec. 300.115 through 300.120, and

Each public agency must ensure that-- (i) To the maximum extent appropriate, children with disabilities, including children in public or private institutions or other care facilities, are educated with children who are nondisabled; and (ii)

Special classes, separate schooling, or other removal of children with disabilities from the regular educational environment occurs only if the nature or severity of the disability is such that education in regular classes with the use of supplementary aids and services cannot be achieved satisfactorily.

(34 C.F.R. § 300.114) (Authority: 20 U.S.C. 1412(a)(5))

IDEA 1990 required schools to provide assistive technology services and equipment for a student with a disability if it was necessary to ensure a free and appropriate public education (Merbler, Hadadian, & Ulman, 1999). IDEA 97 extended this mandate by requiring IEP teams to "consider assistive technology as a special factor when developing a student's IEP" (p. 113).

*Technology Related Assistance for Individuals with Disabilities Act Amendments of 1994*

The focus of Technology-Related Assistance for Individuals with Disabilities Act Amendments of 1994 (The Tech Act of 1994) was to recognize the individual's need for assistive technology to succeed in school rather than the previous medical model (Alper & Raharinirina, 2006). The Tech Act of 1994 concentrated the states' activities on "the coordination of activities among state agencies, the development and implementation of strategies to empower individuals with disabilities, the increase of outreach to underrepresented populations and the creation of strategies to ensure timely acquisition of AT" (Noble, 2002, p. 51).

Specifically, in 1994, the Tech Act was amended to require each state to perform six specific systems-change and advocacy activities. The six mandated priority activities were:

- (i) The development, implementation, and monitoring of state, regional, and local laws, regulations, policies, practices, procedures, and organizational structures, that will improve access to, provision of, funding for, and timely acquisition and delivery of, assistive technology devices and assistive technology services; (ii) the development and implementation of strategies to overcome barriers regarding access to , provision of, and funding for such devices and services with priority for identification of barriers to funding through state education (including special education) services, vocational rehabilitation services, and medical assistance services or, as appropriate, other health and human services with particular emphasis on overcoming barriers for underrepresented populations and rural

populations; (iii) coordination of activities among state agencies, in or to facilitate access to provision of and funding for assistive technology devices and assistive technology services; (iv) the development and implementation of strategies to empower individuals with disabilities and their family members, guardians, advocates, and authorized representatives, to successfully advocate for increased access to, funding for, and provision of, assistive technology devices and assistive technology services, and to increase the participation, choice, and control of such individuals with disabilities and their family members, guardians, advocates, and authorized representatives, in the selection and procurement of assistive technology devices and assistive technology services; (v) the provision of outreach to underrepresented populations and rural populations, including identifying and assessing the needs of such populations, providing activities to increase the accessibility of services to such populations, training representatives of such populations to become service providers, and training staff of the consumer-responsive 'comprehensive statewide program of technology-related assistance to work with such populations; and (vi) the development and implementation of strategies to ensure timely acquisition and delivery of assistive technology devices and assistive technology services, particularly for children, unless the State demonstrates through the progress reports required under section I04 that significant progress has been made in the development and implementation of a consumer-responsive comprehensive statewide program of technology-related assistance, and that other systems change and advocacy

activities will increase the likelihood that the program will accomplish the purposes described in section 2(b)(1). [29 U.S.C. § 2212(e)(7)(B)]

The first activity reflected Congress's disapproval of the current assistive technology delivery system (Bryant & Seay, 1998). The mission of the first activity was to "change the current system to better enable people with disabilities to access and use assistive technology devices and services"(p.6). The second activity placed state projects in the role of change agents regarding funding. This activity reinforced the mission of the first activity to change the current system and focused on the "state and federal funding policies that serve as barriers to the acquisition and use of assistive technology devices and services" (p. 7). In the third activity, Congress pushed for state projects to increase their interagency collaboration efforts. This push was designed to better coordinate state's activities to reduce the consumer's confusion regarding the "most efficient manner to access funds for the purchase of an assistive technology device" (p. 7). The fourth activity addressed the need for individuals with disabilities to be better self-advocates. The fifth activity focused on "working with groups that are traditionally identified as underrepresented or rural" (p.10). The sixth activity addressed the need for "an efficient system of assistive technology service delivery that provides devices and services in a timely manner" (p. 10). This activity was that "state projects will provide subcontracts to protection and advocacy (P&A) systems to engage in litigation activities that will have a dramatic impact on the way states deliver assistive technology services" (p.11). This activity has led to an increase in the number of court cases involving access to assistive technology devices and services.

One additional main point in the 1994 amendments was "a sunset provision indicating that federal funding would begin to decrease in the final three years of the program and would be eliminated at the end of 10 full years of funding" (Bausch, Mittler, Hasselbring, & Cross, 2005, p. 61). The intent was for states to assume the fiscal responsibility when federal funding ceased.

While the Tech Act of 1988 provided funds to states to develop an effective assistive technology service delivery system, its subsequent reauthorization in 1994, "mandated that state Tech Act projects identify and eliminate systemic barriers that impede the timely acquisition and use of assistive technology devices and services" (Bryant & Seay, 1998, p. 11). Because children and adults with disabilities can "benefit from assistive technology devices and services in school and in the workplace, it is critical that barriers to AT access be eliminated" (p.11). The Tech Act state projects work on behalf of all individuals with disabilities and have provided numerous programs and services to help people with disabilities access and use assistive technology devices.

#### *The 1998 Amendment to Section 508*

Beginning in 1998, federal legislation granted students with disabilities "basic civil rights mandating access to buildings, services, and schooling through Section 504 of the Rehabilitation Act of 1998" (Caverly & Fitzgibbons, 2007, p. 38). These rights were expanded, requiring access to electronic and information technology through the 1998 Amendments to Section 508 (Section 508) (2007) "The intention of Section 508 was to ensure that individuals with disabilities could access electronic information (databases, applications) and manipulate the data and related information" (Mondak, 2000, p. 44).

This legislation set a standard for all government created electronic information including websites to be accessible by persons with disabilities:

individuals with disabilities who are members of the public seeking information or services from a Federal department or agency to have access to and use of information and data that is comparable to the access to and use of the information and data by such members of the public who are not individuals with disabilities. [29 U.S.C. § 508(a)(1)(A)(ii)]

The 1998 Amendment to Section 508 of the Rehabilitation Act "required that all electronic or information technology that is developed, procured, maintained, or used by the federal government be accessible to individuals with disabilities, unless an undue burden would be imposed on the agency" (Marino et al., 2006, p.19). Section 508 required that all Federal information that is accessible electronically must be accessible to individuals with disabilities in a variety of ways, which are specific to each disability.

This amendment was in response to the growth of electronic and information technologies that were emerging for the general public.

#### *Assistive Technology Act of 1998*

The Tech Act of 1994 was repealed and replaced with the Assistive Technology Act of 1998 (hereinafter 1998 AT Act). The purposes of the 1998 AT Act were

(1) to provide financial assistance to states to undertake activities that assist each state in maintaining and strengthening a permanent comprehensive State-wide program of technology-related assistance, for individuals with disabilities of all ages, that is designed to . . . . (2) to identify Federal policies that facilitate

payment for assistive technology devices and assistive technology services, to identify those Federal policies that impede such payment, and to eliminate inappropriate barriers to such payment; and (3) to enhance the ability of the Federal Government to . . . [29 U.S.C. § 3001(b)(1)(2)(3)]

With the 1998 AT Act "Congress shifted the focus from defining and acquiring assistive technology devices and services to providing assistive technology for access to the general education curriculum for students with disabilities" (Dyal et al., 2009, p. 557). The 1998 AT Act continued to support capacity building and advocacy activities through grants and encouraged research of the principles of Universal Design for Learning (UDL) related to assistive technology to address the technological needs of students with disabilities (Beard, Carpenter, & Johnston, 2011). The 1998 AT Act provided funds to states to support three types of programs:

The establishment of assistive technology (AT) demonstration centers, information centers, equipment loan facilities, referral services, and other consumer-oriented programs; (2) protection and advocacy services to help people with disabilities and their families, as they attempt to access the services for which they are eligible; and (3) Federal/state programs to provide low interest loans and other alternative financing options to help people with disabilities purchase needed assistive technology ("Assistive Technology Laws", n.d.).

The goal of the 1998 AT Act was to increase access to assistive technology devices and services for individuals of all ages and across all disabilities (Bailey, Meidenbauer, Fein, & Mollica, 2005). Under the 1998 AT Act, "state AT Act projects must focus on achieving progress in five goal areas: employment, health care, community living, education, and telecommunications/information technology" (p. 31).

#### *Assistive Technology Act of 2004*

The Assistive Technology Act of 1998 was reauthorized and entitled Assistive Technology Act of 2004 (hereinafter 2004 AT Act). The 2004 AT Act did not include a sunset provision. "This means that state programs can expect funding through the life of the bill assuming funds are appropriated, as is the case of most government programs" (p. 61). With this removal, a more reliable stream of funding was identified which also allowed for longer-term planning of projects and the ability to hire qualified individuals.

The 2004 AT Act continued the tradition of setting goals to increase the availability of funding for access to, provision of, and training about assistive technology devices and services. Bausch et al. (2005) summarized the additional goals of the 2004 AT Act:

- (a) increase the use of AT in the transition from one program to another, (b) increase the involvement of individuals and their families in the decision making process, (c) increase the capacity of public agencies to provide and pay for AT, (d) increase coordination among agencies, (e) facilitate the change in AT laws and policies, and (f) increase awareness and knowledge of the benefits of AT. (p. 61)



Another major change brought about by the 2004 AT Act was a change in purpose. Previous Acts focused on helping states build "systems for improving access to assistive technology devices for individuals with disabilities" (Boehner, 2004). Under the Assistive Technology Act of 2004, states would be required to use a majority of federal funds to directly help individuals, switching the primary purpose from establishing systems to directly helping the individuals with disabilities that need assistive technology devices:

Increase awareness and knowledge of the benefits of assistive technology devices and assistive technology services among targeted individuals and entities and the general population; and {2) to provide States with financial assistance that supports programs designed to maximize the ability of individuals with disabilities and their family members, guardians, advocates, and authorized representatives to obtain assistive technology devices and assistive technology services. [29 U.S.C. § 3001{8)(b){1)(G){2}]

"Although school-age children with disabilities ....will continue to receive the bulk of their services from IDEA, which mandates that all students with an IEP must be considered for AT, the AT Act will also have several implications for students" (Bausch et al., 2005, p. 64). The state-run awareness and information activities are anticipated to increase awareness of assistive technology which will improve the likelihood that students will receive the assistive technology devices and services they need. Additional components of AT Act include device reutilization, device demonstration, and device

loan programs at the state level which should provide additional benefits to parents, teachers, administrators, and students with disabilities.

The definition of an individual with a disability was modified to include people of all ages. The 2004 AT Act defines eligibility as:

(A) Individual with a disability. -The term "individual with a disability" means any individual of any age, race, or ethnicity- (i) who has a disability; and (ii) who is or would be enabled by an assistive technology device or an assistive technology service to minimize deterioration in functioning, to maintain a level of functioning, or to achieve a greater level of functioning in any major life activity.  
[29 U.S.C. § 3001(10)(A)(i)(ii)]

By expanding the definition of eligibility, the 2004 AT Act can be "assumed to assist many of the 54 million individuals currently identified with a disability,, (Bausch et al., 2005, p. 59). Overall, the 2004 AT Act provided a more optimistic future for assistive technology.

All the Tech Act laws have been a major force in helping children and adults with disabilities live more productive and independent lives in their schools, workplaces, neighborhoods, and communities. The Tech Act first defined assistive technology devices and services; however, it was the Individuals with Disabilities Education Act (IDEA) that outlined the school district's responsibility to provide assistive technology to students with disabilities.

*Individuals with Disabilities Education Act, Amendments of 1997*

The Individuals with Disabilities Education Act, Amendments of 1997 (hereinafter IDEA 97) continued to expand access to the general education curriculum for children with disabilities. Two of the main inclusions in IDEA 97 were the consideration factor and pushing for the LRE to be the general education setting.

IDEA 97 listed five special factors that the IEP team must consider in the development, review, and revision of each child's IEP. One of these five factors was "consider whether the child requires assistive technology devices and services" [20 U.S.C. §1414(d)(3)(B)(v)].

Amendments to IDEA in 1997 extended assistive technology responsibilities to include several important mandates that further extended individuals' with disabilities rights including: (a) students should be educated in general education classrooms to the maximum extent possible, (b) IEP teams must consider AT for every student during the development of an IEP, and (c) AT may continue to enhance students' access to FAPE outside of the school (e.g., in the student's home). The legislation bolstered student access to the general education curriculum and placed increased responsibility on special education teachers and IEP team members to make informed AT decisions. (Marino et al., 2006, p. 19)

These Amendments to IDEA 97 defined every child's right to a Free and Appropriate Public Education (FAPE) and in doing so clearly relieved the student of the cost associated with assistive technology devices or services. The burden of the cost of

assistive technology required by the student with disabilities was the responsibility of the public schools. IDEA "requires that assistive technology devices and services be provided to children and youth with disabilities if these are necessary to ensure a free, appropriate public education" (Lewis, 1998, p. 24), The 1997 Amendments to IDEA required public education agencies to insure that assistive technology is considered as a regular component in the IEP development process and if assistive technology devices or services are needed they are included as special education, related services, or supplementary aids or services within the student's IEP (Dalton, 2002).

Children with disabilities were starting to see better access to the general education curriculum. The requirement for every IEP team to consider the need for assistive technology is a giant step forward (Reed & Bowser, 1999). "It is an opportunity for parents to encourage a thoughtful discussion of the potential use of assistive technology for their child" (p. 58). IEP team members are required by IDEA 97 to consider assistive technology which is more than "simply making a check mark on the IEP that the team has considered AT" ( Parette & Peterson-Karlan, 2007, p. 391).

#### *Individuals with Disabilities Education Improvement Act 2004*

The Individuals with Disabilities Education Improvement Act (IDEA 2004) was not proposed to overhaul IDEA 97, but rather to attend to some issues that had arisen during the intervening few years (Mittler, 2007). An important congressional finding was included in IDEA 2004:

- (5) Almost 30 years of research and experience has demonstrated that the education of children with disabilities can be made more effective by ....(H)

supporting the development and use of technology, including assistive technology devices and assistive technology services, to maximize accessibility for children with disabilities. [(20 U.S.C. §1401 (c)(5)(H)]

"Assistive technology devices and technology services can be related services. When used to support a student in the regular class setting, they can also be considered supplementary aids and services" (Bartlett, Etscheidt, & Weisenstein, 2007, p. 92). It is important for teachers to consider every student individually to determine if they need assistive technology. Once the teacher and the team decide the assistive technology is necessary it needs to be placed in the IEP and provided to the student. The Code of Federal Regulations states:

Sec. 300.105 Assistive technology. (a) Each public agency must ensure that assistive technology devices or assistive technology services, or both, as those terms are defined in Sec. Sec. 300.5 and 300.6, respectively, are made available to a child with a disability if required as a part of the child's--( 1) Special education under Sec. 300.36; (2) related services under Sec. 300.34; or (3) Supplementary aids and services under Sec. Sec. 300.38 and 300.1 14(a)(2)(ii). (b) On a case-by-case basis, the use of school-purchased assistive technology devices in a child's home or in other settings is required if the child's IEP Team determines that the child needs access to those devices in order to receive FAPE (34 C.F.R § 300.15) (Authority: 20 U.S.C. 1412(a)( 1), 1412(a)(12)(B)(i))

One of the special factors to be considered under IDEA 97, "whether the child requires assistive technology devices and services" [20 U.S.C. §1414(d)(3)(B)(v)], was changed to read "consider whether the child needs assistive technology devices and services" [20 U.S.C. §1414(d)(3)(B)(v)] in IDEA 2004. Mittler (2007) speculated this change would possibly result in a more liberal interpretation of assistive technology which could lead to more students with disabilities being able to access available assistive technology devices and services.

Throughout history, the federal government has played a critical role in requiring considerations of assistive technology needs for students with disabilities. "This stimulation has been in the form of federal laws and regulations that have included technology mandates and funding to support a wide variety of technology research and development, training, and service activities" (Blackhurst, 2005a, p. 12), The Tech Act. (1988) included the first definitions of assistive technology devices and services. It also authorized federal funds for states to initiate assistive technology plans. The ADA's (1990) intent was to eliminate discrimination and provide equal opportunities for individuals with disabilities. The ADA extended civil rights to people with disabilities in both the public and private sectors and created access to public education for students with disabilities.

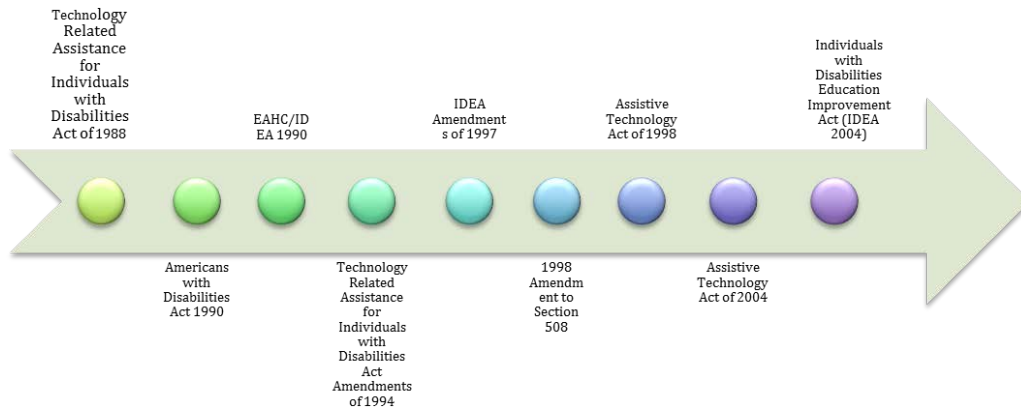
The Tech Act of 1994 was in response to Congress's dissatisfaction with the states' current assistive technology delivery systems. In response to the growing electronic and informational technologies, the 1998 Amendment to Section 508 required individuals with disabilities be provided access to any electronic or informational

technology that was developed, procured, maintained, or used by the federal government. The AT Act (1998) extended funding provided in the 1988 Tech Act to assist states in "promoting awareness about assistive technology, provide technical assistance, outreach, and foster interagency coordination" (Blackhurst, 2005a, p.14). The Assistive Technology Act of 2004 required states to use a majority of federal funds to directly help individuals, switching the primary purpose from establishing systems to directly helping the individuals with disabilities that need assistive technology devices.

The IDEA 2004 continued to strengthen the educational outcomes expected for all individuals with disabilities. By providing special education services designed for each student's unique needs, the expectations were that all students with disabilities would be prepared for further education, employment, and independent living. Assistive technology could be one of these special education services that help students with disabilities meet these ongoing expectations.

The Individuals with Disabilities Education Act's main purpose was to guarantee the right of all children with disabilities to a free and appropriate public education in the least restrictive environment. Assistive technology devices and services may be viewed as a method or valuable educational tool for students with disabilities to access a FAPE in the LRE. It could make things possible for students with disabilities that could not otherwise be obtained. The ongoing emphasis on assistive technology was a positive influence in the lives of children with disabilities.

Figure 1. Legislative Timeline



### *Perspectives on assistive technology*

There is a great deal of interest in assistive technology and its potential to produce positive educational outcomes for students with disabilities (Todis & Walker, 1993).

Todis (1996), however, found that introducing assistive technology devices into the lives of students with disabilities and their families added a profound level of complexity to their lives. To better understand this complexity, Todis (1996) attempted to describe the experience of assistive technology from the perspectives of those who were the most closely connected to the process of introducing assistive technology into the lives of students with disabilities. She considered the perspectives of parents, specialists (including physical therapists occupational therapists, and speech language therapists), special education teachers, instructional assistants, regular classroom teachers, the students with disabilities, and their peers. Of particular interest is her exploration of



parental perspectives. She suggests that parents “experience an evolution of attitudes toward assistive technology, from surprise and confusion when it is first suggested, to resignation or tentative hope that a device will promote development and social interaction” (Todis, 1996, p. 51). She also identifies an initial resistance on the part of parents. Eventually, the parents in her study came to view assistive technology as either one tool among many to increase their child’s independence, or as a “magic bullet” that enables the student to overcome all limitations and allow others to see their child as they, the parents see the child.

#### *Obstacles to the use of assistive technology*

Despite all the benefits of using assistive technology, there are several barriers to overcome for children with disabilities to realize the potential benefits of assistive technology. As noted above, Todis (1996) identified an initial resistance on the part of parents to adopt assistive technology. In their qualitative study, Hutingger, Johanson, and Stoneburner (1996) explored barriers to effective assistive technology implementation. One theme that emerged was parental ability and attitude toward the implementation of assistive technology. Parent’s expressed concern about the availability of training, their comfort and ability with computers and computer technology, unfamiliarity with solving hardware and software problems, difficulty obtaining software, and a lack of collaboration between parents and school staff. The area of parental attitude and difficulty are of particular interest because parents are often their child’s strongest advocate. Other barriers identified include those identified by Parette and Murdick

(1998). They discussed three obstacles to the effective implementation of assistive technology; lack of training, technology abandonment, and expense.

Assistive technology can have a positive impact on a student's learning, although a gap exists between the potential of assistive technology and the reality of a student with disabilities successfully accessing the general curriculum with assistive technology (Edybum, 2000a, 2004; Morrison, 2007; Zabala et al., 2000). Some researchers have attempted to identify barriers to the successful implementation of assistive technology (Derer et al., 1996; Lewis, 1998; Morrison, 2007; Todis, 1996).

In Todis' 1996 study, identification of the proper assistive technology device, unrealistic outcome expectations, failure to replace or repair devices, budgetary constraints, and technical difficulties issues and barriers reported (Todis, 1996). Another study identified six barriers which accounted for 62% of the comments received from their study (Derer et al. 1996). These barriers were: (a) obtainability of equipment, (b) time management, (c) monetary expense, (d) monetary funds, (e) teacher knowledge, and (f) teacher training.

Wehmeyer (1999) identified the six factors that served as barriers to assistive technology use: (a) lack of funding and/or high cost of the devices; (b) little information available about products; (c) assessment/evaluation not available; (d) products unavailable; (e) device too complex for a person to use; (f) product upkeep too difficult; and (g) inadequate training for a person to learn to use the device.

Comfort with technology in general, and with assistive technology in particular, has been increasing rapidly, yet professionals are still apprehensive that assistive

technology services have been overlooked (Edyburn, 2002a; Bausch & Ault, 2008). The literature reviewed for this study revealed many similarities in the identification of barriers in the effective identification and application of assistive technology in schools. For this study barriers to assistive technology were categorized into financial barriers and limitations of teacher knowledge.

#### *Need for research on the role of parental attitude*

Parental attitudes and abilities are a relatively unexplored obstacle to the effective implementation of assistive technology that needs further research. Hutinger, Johanson, and Stoneburner (1996) recommend improved assistance to families, as well as a system of support for families. They identify one of the key dependencies for the effective use of assistive technology as “the interest, resources, and persistence of families” (Hutinger et al., 1996, p. 34). Xu, Reid, and Steckelberg (2002) note that very little empirical data is available to guide the effective implementation of assistive technology for students with cognitive disabilities (specifically ADHD). One area that should be explored is how parental attitudes affect the implementation of assistive technology.

#### *Summary of Literature Review*

In summary, the literature clearly shows how The Tech Acts, ADA, and IDEA legislative initiatives have provided numerous programs and services to help people with disabilities have equal access and use of assistive technology devices and services. The legislative initiatives illustrate the importance the federal government has placed on assistive technology in the lives of children with disabilities. The combination of the

appropriate assistive technology device and assistive technology services can enhance the likelihood of success and overall well-being for a student with disabilities.

This section of the literature review invited questions pertaining to the teacher's knowledge of legislation regarding assistive technology devices and services. Teachers need to know the laws and possess the skills to implement these laws and assistive technologies to effectively provide access to the general education curriculum and meet the challenge of providing the best education possible for all students with disabilities. Do teachers know these laws so they are able to provide the necessary opportunities for students with disabilities?

The continuous work of legislators to enact laws to benefit students with disabilities will be in vain if educators do not know and understand the legislative requirements. In order to meet the legal obligations of these statutes, teachers must have a clear understanding of assistive technology devices and services and a methodology for identifying the assistive technology needs of students with disabilities.

Given the spotty nature of empirical research concerning potential barriers to effective implementation and use of assistive technology, there is room to examine specific barriers and how they affect the implementation of assistive technology. Given the large role that parents play as advocates and caregivers in the lives of their children, as well as their role in troubleshooting and maintaining the assistive technology their children makes use of, I explored this potential barrier to better understand ways to help and support parents to help and support their children with disabilities effectively use assistive technology.

Assistive technology has been formed through legislative acts in an effort to provide benefits and eliminate barriers to access for students with disabilities. Assistive technology devices and services are one service included in a free appropriate public education (FAPE) in the least restrictive environment, which every student with a disability is entitled to.

Teachers need to know the laws and their requirements and what assistive technology is to consider, evaluate, and provide appropriate recommendations of assistive technology devices and services to students with disabilities. Teachers must have this legal background and awareness of assistive technology to enhance benefits and alleviate barriers children may encounter.

## CHAPTER 3: DESIGN OF THE STUDY AND RESEARCH METHODS

### Qualitative Approach

A qualitative approach was used for this study so that I could gain a deeper understanding of what was happening in the process of assistive technology adoption. Many methodological approaches fall under the qualitative umbrella. For this study, I attempted to pay attention to holism, context, natural occurrence, as well as the participants' frame of reference. Holism refers to the idea that the participants, the problem, and the environment are treated as an intact whole. Natural occurrence means that the researcher is not creating the problem. Not only that, but no attempts are made to alter the outcomes or behavior of the participants or the outcomes associated with the setting. Instead, the problem as it occurs without the presence of the researcher is studied. The participants frame of reference is very important. This is keeping with the emic perspective. Stake (1995) describes the emic perspective as follows: "These are the issues of the actors, the people who belong to the case. These are issues from the inside" (p. 20). This orientation interprets the actor's frame of reference. When using this approach, the research questions are designed to aid in understanding the participants point of view. Data analysis and interpretation are focused on understanding this point of view.

### Statement of the Research Questions

The purpose of this study was to obtain a detailed description of the perception that parents and special education teachers have of assistive technology for students with cognitive and developmental disabilities such as, but not limited to, Autism, ADD/ADHD, or FASD. This description was created by exploring several key factors

that contribute to parents' and special education teachers' overall perceptions of assistive technologies. These factors include:

- The parents' perception of their child's need for this type of support
- The special education teachers' perception of their students' need for this type of support
- Parents' and teachers' impression of the benefits of assistive technology in general and for the child
- Parents' and teachers' perception of the challenges of assistive technology use
- Teachers' understanding of the availability of assistive technology
- Teachers' awareness of available resources to help with the implementation of assistive technology
- Teachers' attitude toward technology in general

These factors were explored in a grounded theory study using interviews of parents whose children have a disability and an Individual Education Program (IEP) and Special Education teachers in an attempt to answer the following questions:

1. How do parents of students with disabilities perceive the role of assistive technology in the success of their children?
2. How do special education teachers perceive the role of assistive technology in the success of their students?

3. How do special education teachers perceive their role in integrating assistive technology within their classroom?
4. How do parents perceive their role in helping their children to use assistive technology?
5. How much support and assistance do parents and special education teachers feel they have in implementing assistive technology?
6. How well are parents and special education teachers communicating with each other about the assistive technology needs of the child?
7. What barriers to parents see in implementing assistive technology in their child's IEP?
8. What barriers to special education teachers see in implementing assistive technology I their students' IEP?

### Grounded Theory Method

A grounded theory study attempts to generate a theory or discover themes that relate to the situation being studied. Strauss and Corbin (1990) describe the grounded theory method as:

... it is discovered, developed, and provisionally verified through systematic data collection and analysis of data pertaining to that phenomenon therefore, data collection, analysis, and theory stand in reciprocal relationship with each other. One begins with an area of study and what is relevant to that area is allowed to



emerge (pp. 24-25).

Data for a grounded theory study comes from interviews with participants who have a relationship with this situation. Grounded theory studies try to explain why something occurs (or fails to occur). As Creswell states, “The centerpiece of grounded theory research is the development or generation of a theory closely related to the context of the phenomenon being studied” (Creswell, 1998, p. 56). A grounded theory study was used here to generate a theory regarding the barriers that prevent or retard the implementation of appropriate assistive technology and services for children.

The grounded theory method uses a continual repeated process that identifies a phenomenon of interest, which is then pursued using interviews and observations as methods of data collection. The data is analyzed to identify information that seems relevant to the topic of interest. Any relevant information is placed into categories that are then evaluated for their ability to help answer the guiding questions of the study. Anything that is unanswered or unconfirmed by the initial data is used to select another study participant.

This process continues until all categories of interest reach the stage of saturation. Saturation occurs when the conditions influencing the categories have been identified, their interrelationships are explained, and explanations and claims are verified by the data.

The result of this process is the development of a theory about the topic and how it operates. The theory is said to be “grounded,” or verified by the data. While this study did not produce a full theory concerning barriers to the effective implementation of

assistive technology for students with cognitive disabilities, it did lay the groundwork for further exploration of this topic. This groundwork is presented in Chapter Five, Discussion and Conclusions.

### Data

The data consisted of interviews with parents and teachers, themes generated via literature review, IEP forms used in the participants' respective school districts, and a review of the technology requirements for teacher preparation programs in the state of Minnesota. Teacher preparation programs for the state of Minnesota were used because the participants of the study were all either teachers in Minnesota, or parents of students in Minnesota schools. Finally, demographic information from represented school districts was used.

### *Interviews*

The researcher conducted interviews with each participant. These interviews were digitally recorded, reviewed for clarity and accuracy, and then transcribed. Each interview lasted between 30 and 60 minutes, and took place in various locations chosen by the participants, including local restaurants, public libraries, schools, and homes. Participants indicated that they felt comfortable enough with the interview setting to be able to respond honestly to the interview questions.

### *Literature*

As themes emerged from the interview data, a follow-up literature review was conducted for each theme. This literature review was focused on finding what, if any, prior research either supported or contradicted each particular theme. Some of the themes

yielded very little in the way of prior research, and these areas obviously warrant further research. Other themes were supported, at least in a limited way, by prior research. This support helps validate the themes that were generated.

#### *District IEP Forms*

District IEP forms were used in order to explore how the various expectations different school districts have regarding assistive technology as communicated by the emphasis placed on assistive technology services as reflected in their IEP templates. This data source was used to confirm comments made by several teachers and parents regarding the importance and support districts placed on assistive technology.

#### *Teacher Preparation Requirements from Minnesota Schools*

During data analysis, one theme that emerged was the important role played by the special education teacher's comfort and familiarity with assistive technology. To better understand the impact this has on overall assistive technology adoption rates, as well as gather information for recommendations, the researcher contacted teacher preparation programs at various colleges throughout the state of Minnesota in order to ascertain the amount and quality of training special education teachers received in their initial licensure program.

#### *Sampling*

The subjects of this study consisted of parents of children with disabilities that are primarily cognitive in nature, including, but not limited to ADD/ADHD, Autism, intellectual disability, FASD, Learning Disabilities, and Dyslexia, and special education teachers. These parents and teachers were recruited through local school districts and

with the help of PACER. PACER is an advocacy group that specializes in assisting parents of children with disabilities in many areas of life, including assistive technology. All participants were volunteers. The number of participants included six parents and six teachers. The parents and teachers came from districts that represented a total of 77,735 students, 10,854 of whom had IEPs. The teachers had a combined 233 students on their case-loads.

### *Instrumentation*

Interviews were conducted via one-on-one interviews at a place of the interviewee's choosing using the interview protocols in Appendix A. Interview questions were adapted to each individual participant, and additional follow-up questions were added to explore interesting themes and ideas because the grounded theory method calls for constant adaptation in order to seek necessary information to develop a theory (Strauss & Corbin, 1990, p.178). All interviews were recorded with a digital audio recorder, transcribed, and analyzed using NVIVO.

### *Data analysis procedures*

Data analysis was conducted using the extensive guidelines offered by Strauss & Corbin (1990) using the grounded theory method. The exhaustive list is not included here, however, the more important analysis techniques included constant comparison which involves repeating the processing of gathering data, formulating a hypothesis, seeking confirmation or disconfirmation to the point of completion and saturation), coding (open, axial, and selective), categorization (identification of characteristics, frequency, duration, and intensity), and conceptualization (Strauss & Corbin, 1990).

Interviews were transcribed and entered into NVIVO in order to explore themes in parents' responses. Thematic data analysis was conducted using the constant comparative method defined by Glaser & Strauss (1967). Themes were coded and compiled. Data collection and analysis was an ongoing and simultaneous process, so interview questions were at times revised as the interview process progressed to capture additional data on emerging categories. Interviews were conducted until all categories had been saturated and no further categories emerged. The results of the follow-up interviews were also entered into NVIVO for coding. Once all the data were coded, the resulting codes were organized into themes for final analysis.

#### *Trustworthiness of the Data*

In order to establish the trustworthiness of the data, several methods, described below, were used. These methods included using varied sources of information, and confirmation steps related to working with the data.

#### *Varied Sources of Information*

12 people participated in this study. The participants varied in their role (teacher vs. parent), comfort with technology in general, and experience with assistive technology. In keeping with grounded theory principles, following the first interview, additional participants were purposely selected to explore and advance developing ideas and theories related to barriers to assistive technology implementation. Specifically, several interviews with parents led to follow-up interviews with special education teachers in their district.

### *Confirmatory steps*

Two important steps contributing to the trustworthiness of the data were Member Checking and Reliability Coding. These are described below.

#### *Member checking.*

Prior to interviewing participants, they agreed to review a written transcript of their interview, also known as Member Checking. The purpose of the Member Check is to verify that the transcript accurately portrays the participant's comments during the interview. It also allows participants the opportunity to correct misinformation. Once a written copy of the transcript was produced, I sent it to the participant with instructions for reviewing the transcript.

#### *Reliability coding.*

I used a Reliability Coder to help validate my coding. A Reliability Coder, at my request, reviewed my work to confirm that my decisions in establishing the data for the study and assigning codes conformed to the stated criteria. I chose a person who is knowledgeable of scholarly research methods. This person was a current graduate student who had finished all coursework and was "ABD". The Reliability Coder was helpful in two different ways. This person helped me to confirm the units for analysis. They also helped confirm the assigning of codes that represented the five parts of the theory produced by the study.

#### *Units for analysis.*

To confirm the reliability of the units identified as data for the study I gave the Reliability Coder a definition of a unit for analysis for this study and a transcript. I had an

identical copy of the same material. Individually the Reliability Coder and I each “unitized” the same transcript. I then compared the Reliability Coder’s unitized transcript to mine and found an acceptable 70% rate of agreement between the two. The process of determining the rate of agreement was informed by Scott and Hatfield (1985).

*Verifying codes.*

Next the Reliability Coder worked with me to verify the codes related to the six components of the theory produced by the study. To complete this phase I provided the Reliability Coder with a Coding Guide, Appendix R, that gave the characteristics of six codes that could be assigned to a unit for analysis along with a set of instructions, Appendix S.

The Reliability Coder and I took the following steps to verify the reliability of my assignment of codes to the units for analysis. We agreed to go through three sequences of assigning codes. We used two different transcripts that we had not already used during the unitizing. One transcript was used for the first and second sequences of verifying the codes and the second transcript was used for the third sequence.<sup>[11]</sup><sup>[SEP]</sup> The first two sequences of verifying the codes involved the following. To train and to gain experience, we each separately and independently, and using the Coding Guide, assigned codes to the units in the first half of the same transcript. The Reliability Coder returned the coded transcript to me and I then compared the rate of agreement with the transcript that I had coded.

To calculate the rate of agreement I first counted the total number of all units available for coding, next I separately counted and totaled the number of units having the

same code assigned to them, and counted and totaled the number of units having a different assigned code. I then divided the total number of available units into the total number of units having the same code assigned. In the first sequence we achieved an 83% rate of agreement. Because we had achieved a high rate of agreement the Reliability Coder and I agreed to move on to coding the second half of that same transcript and looked upon this as the second sequence of verifying the codes. We also agreed the second sequence would serve as part of the actual verification rather than as training.

The second sequence was handled just like the first sequence in that we each worked independently and used the Coding Guide to assign codes to the units in the second half of the transcript. Once the Reliability Coder returned the coded transcript to me, I again compared the rate of agreement between the assigned codes and determined a 75% rate of agreement for the second sequence of the coding (Appendix T). The Reliability Coder and I discussed the reasons for the lower rate of agreement in assigning codes. Based on our conversation I made revisions to the Coding Guide and we undertook the third sequence of verifying the codes.<sup>[11]</sup><sub>SEP</sub> The third sequence involved coding a full transcript that was different from the transcript used in the first two sequences or in the unitizing. We followed the same procedures used in the first two sequences. I mailed the Reliability Coder a copy of the transcript and we each separately and independently used the Coding Guide to assign codes to the units of the transcript. Again, the Reliability Coder returned the coded transcript to me and after comparison with my assigned codes I determined an 83% rate of agreement.



As we were able to consistently attain fairly high levels of agreement about the assignment of codes through three sequences of coding, it seemed reasonable to end the verification activities and conclude the codes were being appropriately applied.

#### *Miscellaneous Actions to Further the Reliability of the Data*

In addition to the steps that have been described other actions were part of the activities of the study and contributed to the reliability of the data. These miscellaneous actions will now be described.

#### *Researcher notes*

Over the course of the study I made notes regarding my personal thoughts, perceptions, insights, and thinking about various events and elements of the project. During the interviewing phase, after completing an interview, I wrote down my recollections about the interview. I tried to write down what seemed important, what stood out in my mind about what the participant had said, and what questions arose or seemed unanswered. I also made notes to “make sense” of what I was learning from the interviewing. The process of casually writing and reflecting upon the experience of the interviews and trying to understand what had been told to me helped me to gain insight and perspective.

I also made notes about casual conversations I had related to the IEP process. Generally such conversations came about through an approach I made as part of recruiting participants for the study. For example I had lengthy conversations with two separate prospective participants who did not become participants of the study. A variation of this casual, informative conversation involved my contacts with people who

might have been sources for recommendations of potential participants. For example, I conversed with several parents who had been through the IEP process, as well as teachers and administrators who worked in special education.

As the study progressed my notes focused more on the analysis of the data. Notes of this type included my thinking about categories and codes, the relationships of categories, and sketches of the emerging theory. I also kept notes related to the administration of the study such as when interviews took place, suggestions of people to contact about the study and who recommended them, and meetings and contacts related to carrying out the study. The role and purpose of the researcher notes and records was to document and develop insight into the experiences and processes I was trying to understand; the notes did not serve as data in the study.

#### *Participants of the study*

This study consisted of 6 parents of children with a cognitive disability who currently have IEPs through their school and 6 special education teachers. The parents represent 5 different school districts in Minnesota, District 11 (Anoka-Hennepin), District 279 (Osseo Area Schools), District 877 (Buffalo-Hanover-Montrose), and District 271 (Bloomington), and District 294 (Houston). The parents were all from middle to upper-middle class families living in the suburbs of the Minneapolis/St. Paul metropolitan area. Table 1 gives more information on each parent.

Table 1

<b>Parent</b>	<b>Self-assigned technical ability</b>	<b>Child's Disability</b>	<b>Assistive Technology on IEP?</b>
Parent 1	Below average	ADHD	No (never discussed)
Parent 2	Below average	FASD/OHI	No (never discussed)
Parent 3	Below average	Visual Processing Disorder	No (never discussed)
Parent 4	Below average	ADD, information processing disorder	No (never discussed)
Parent 5	Average	FASD, Visually impaired	Yes (suggested by district)
Parent 6	Average	1 child with Autism  1 child with Autism,  Dislexia, ADHD,  Receptive and expressive language disorder	Initial school district  IEP had no assistive technology (never discussed)  Virtual school IEP  had assistive technology to assist in online schooling

The teachers come from 4 different school districts in Minnesota, District 11 (Anoka-Hennepin), District 279 (Osseo Area Schools), District 877 (Buffalo-Hanover-Montrose), and District 271 (Bloomington). Table 3 shows the characteristics of each teacher, while table 2 shows the characteristics of each district According to the National Center for Education Statistics.

Table 2

<b>District</b>	<b>Number of Students</b>	<b>Students with IEPs</b>	<b>Teachers (FTE)</b>	<b>Total Expenditures</b>
District 011	38250	5534	2197.82	\$430,596,000 (\$11,113 per student)
District 279	20913	2971	1448.54	\$279,524,000 (\$13,363 per student)
District 877	5906	829	300.66	\$61,356,000 (\$10,449)
District 271	10,382	1451	753.24	\$141,643,000 (\$13,250)
District 294	2284	69	124.41	\$18,788,000 (\$8,410 per student)

Table 3

Teacher	<b>Tech Savvy Rating (Self Assigned)</b>	<b>Number on caseload with AT</b>	<b>AT Section on IEP Form</b>	<b>How AT decisions are made</b>
Teacher 1	4	5/12	A fill in section	Team (Team discusses needs based on what they collectively know)
Teacher 2	4	8/17 (calculators)	Check box section	Team (teachers/special ed teachers will generally pre- meet to brain storm solutions)
Teacher 3	-1	4 or 5 /50	Check box	IEP Team (mostly teacher driven).
Teacher 4	0	3/21	Check box	IEP Team
Teacher 5	8	15/73	Check box	IEP Team
Teacher 6	3	3/60	Check box	IEP Team

## *Participant Profiles*

### *Parent 1*

Parent 1 is the married parent of 3 children, the oldest of whom was diagnosed with ADHD after severe struggles in school and with behavior. Parent 1 has a self-described technical ability as “below average”, and had never heard of assistive technology despite having a child with an IEP where assistive technology was marked as being considered.

### *Parent 2*

Parent 2 is the married parent of 5 children, 2 of whom are adopted, and the youngest of which was diagnosed with FASD and has an IEP based on Other Health Impairment. Parent 2 self describes as “not a very technological type person”, but had heard of assistive technology, despite it never having been brought up during the IEP process.

### *Parent 3*

Parent 3 is the married parent of 2 children, the oldest of which has a visual processing disorder and an IEP. Parent 2 claims to “not be very technologically savvy,” although had heard of assistive technology. assistive technology was not brought up or discussed during the IEP process.

### *Parent 4*

Parent 4 is the married parent of 3 children, the youngest of which has ADHD and an information processing disorder and an IEP. Parent 4 claims to be “terrible” with technology, although lives in a household with very tech savvy people. Parent 4 had

heard of assistive technology, but didn't know what it actually was. assistive technology was not brought up or discussed during the IEP process.

*Parent 5*

Parent 5 is the married parent of 4 children, the youngest 2 of whom are adopted. The third child has a visual impairment and FASD, and has an IEP based on those diagnoses. Parent 5 claims to be "comfortable" with technology, and has heard of assistive technology, because it is included on the child's IEP.

*Parent 6*

Parent 6 is the re-married parent of 3 children, one who has Autism, and one who has Autism, Dislexia, ADHD, and receptive and expressive language problems. Both have an IEP. Parent 6 claims to be "comfortable" with technology, but had not heard of assistive technology. Assistive technology was not brought up or discussed during the initial IEP process, but was covered when the children transitioned to an online school.

*Teacher 1*

Teacher 1 is a DCD teacher at a suburban school with 12 students on his/her caseload. 5 of these students have assistive technology on their IEP. Teacher 1 self rates as a 4 (out of 10) when it comes to technological comfort/ability.

*Teacher 2*

Teacher 2 is an SLD teacher at a suburban school with 17 students on his/her caseload. 9 or 10 of these students have assistive technology on their IEP, but most are for the use of calculators. Teacher 2 self rates as a 4 (out of 10) when it comes to technological comfort/ability.

### *Teacher 3*

Teacher 3 is an EBD, SLD, and transitions teacher at a suburban school with up to 50 students on his/her caseload. Teacher 3 was not really aware of how many of these students had assistive technology on their IEP. Teacher 3 self rates as a -1 (out of 10) when it comes to technological comfort/ability.

### *Teacher 4*

Teacher 4 is licensed in all areas of special education at a suburban school with 21 students on his/her caseload. 1 or 2 of these students have assistive technology on their IEP. Teacher 4 self rates as a “thumbs down” or 0 when it comes to technological comfort/ability.

### *Teacher 5*

Teacher 5 is a special ed teacher and occupational therapist at a suburban school with 73 students on his/her caseload. 15 of these students have assistive technology on their IEP as an Occupational Therapy related service. Teacher 5 just received a technology certification from a local university, and self rates as a very proficient when it comes to technological comfort/ability.

### *Teacher 6*

Teacher 6 is a transitions teacher at a suburban school with up to 60 students on his/her caseload, 3 of which had assistive technology on their IEP. Teacher 3 self rates as average when it comes to technological comfort/ability.



### *Ethical considerations*

In this study, subjects were asked to be open and honest about their attitudes and opinions concerning their children, disabilities, and assistive technology. To ensure that parents felt free to share their honest opinions without fear of repercussions, the interviews contain no identifying information, and real names or identifying information are not be used in reporting results. The interviews and transcripts are kept confidential, and will not be shared with anyone but those involved in conducting the research. Taking these steps to ensure anonymity helped minimize threats of repercussions for expressing honest opinions by the subjects.

### *Preparation and Qualifications for Conducting This Research*

In preparing to conduct this study, the researcher has met the rigorous coursework requirements for a doctoral degree in Learning Technologies with a supporting minor in Educational Psychology. The courses covered research methodology preparation (CI 8133, EPSY 5247, EPSY 5261, EPSY 5262, EPSY 8247, and EPSY 8694), preparation in conducting qualitative interviews in educational research (EPSY 8247) and subject matter preparation (CI 5331, CI 5336, CI 5362, CI 5363, CI 5367, CI 8395, EPSY 8993, EPSY 5616). The researcher also has done extensive independent reading in the areas of technology use by children with disabilities and Individual Education Plans, including subscriptions to *The Journal of Special Education Technology* and *Exceptional Children*. Finally, The researcher has significant personal experience in this area as the father of a child with disabilities in the public school system. This preparation and experience gives

the researcher a unique perspective and ability to conduct the research outlined in this proposal.

## CHAPTER FOUR – FINDINGS AND INTERPRETATIONS

### Introduction

In examining the major findings of this study, a narrative overview of the parents' perspective and the teachers' perspective of assistive technology, and the barriers each group encounters in implementing assistive technology on students' IEPs was developed. After the general narrative for both groups was developed, a closer examination of how that narrative answers the research questions occurs.

### Major Findings of the Study

#### *Parental Findings*

From a parental perspective, the most important finding in this study was that parents were universally willing to try whatever recommendation was made to help their children learn. As Parent 2 put it, "I mean, if it's something that's going to help him, I'd be excited to try something more, that possibly could, um, be a tool for him to use, from now until the end of his schooling, to help him, just stay on track, and to hopefully stay where his, stay at the level of his peers."

As Teacher 2 observed: "almost all parents that I can think of over the years have been responsive and accepting to the fact that whatever's gonna help their son or daughter be successful, they're generally for it."

Teacher 6 also observed "Because I think every parent I work with would access anything that would help and support but they're just not aware or maybe know the questions to ask or how that could be helpful."

Teacher 5 put it more bluntly when asked how parents react when they are told their child needs some sort of assistive technology. “I have never seen a negative response.”

This attitude was reflected in all of the parents who were interviewed. In fact Parent 3, when asked how he/she would feel if their was a piece of technology recommended that might help their child, responded “Relieved... if they would offer us anything that would work I’d be all over it.” While the parents were universally willing to try various approaches and technologies, most felt lost and overwhelmed by the whole situation.

As Parent 1 put it, “M\_\_\_ is our first child, so this was really, I felt like we were, in a very dark room, reaching out, and didn’t know what we were reaching for in front of us, and, it was such a private thing, because, for so many years, we were told it was behavioral, so, it was so, difficult to know where to reach out to ask for help, so we just started with a teacher.”

All the parents echoed this thought. While some had outside resources (relative or doctor), all of them said they would rely almost entirely on their children’s special education teachers to recommend some form of assistive technology. In fact, when asked about what resources outside of school they used, Parent 5 put it very bluntly: “I don’t utilize them.”

This reliance on the school and special education teachers meant that for parents, the real barrier to assistive technology implementation was the willingness and/or ability of the special education teacher to recommend some form of assistive technology, and,

unfortunately, this did not happen very often. In fact, most parents experienced an apparent reluctance on the part of teachers to make assistive technology recommendations. Most had never discussed or even heard of the term. Here is an example from my interview with Parent 4:

Me: Has any one from the school ever talked to you about assistive technology?

Technology supports?

Parent 4: No

Me: Never even brought it up?

Parent 4: I've got to really think. Um, mmm, No, I'd say No.

This exchange was typical of my talks with the other parents. Several had also experienced several had experienced a reluctance on the school's part to even acknowledge their children were in need of an IEP or special services. In fact, the only parent who had a child with assistive technology on their IEP had it put on there because the teacher recommended it. (It should be noted that this child attended a school that had an excellent support system for assistive technology that will be discussed in greater detail in Chapter 6.) So it is clear at this point that parents are willing to try almost anything to help their children, that the parents are relying on the schools and the special education teachers to make assistive technology recommendations for their children, and that assistive technology is rarely being brought up by the schools and special education teachers during IEP meetings. The next step in the process is to examine what is preventing teachers from making assistive technology recommendations.

### *Teacher Findings*

Since parents rely almost entirely on the recommendations of teachers and schools, it is vitally important to better understand what barriers that would prevent or curtail the implementation or recommendation of assistive technology on a student's IEP. For teachers, there were four barriers that directly affected the inclusion of assistive technology in a student's IEP. These factors were their own comfort with technology, their awareness of appropriate assistive technology solutions for their students, school or district support, and financial considerations.

#### *Teacher Technology Comfort*

The biggest factor for teachers in deciding what type of assistive technology (if any) to implement is their own comfort technology in general. Teacher 3, who hadn't recommended any assistive technology for his/her students, had a self-assigned tech savvy rating of -1, and said "You know, when it comes to assistive technology, I um, I've heard of it. I don't have a whole lot of experience, as you can kind of tell by my answers."

This teacher hadn't recommended assistive technology to any of his/her students, although some of those students came with assistive technology on their IEP. To this teacher, the entire thought of technology was somewhat mysterious and was best left to someone else.

Unfortunately, not all teachers are very comfortable with technology. As Teacher 4 put it, "I hear other teachers remark..., 'Well, that we only know so much about a computer. Just what we need to know to do our work.'"

All of the teachers indicated that they would only recommend assistive technology that they were aware of and were comfortable implementing. Further, they would have to specifically know how any recommendation they made would be helpful to their students. These statements were born out by the fact that the self rate most tech savvy teachers had the highest number of students with assistive technology on their IEPs.

### *Teachers Awareness*

A related factor is the teacher's awareness of appropriate assistive technology solutions for their student. Several of the teachers admitted to not being very aware of assistive technology that is available to their students. Teacher 6 put it this way, "If you were to say what, what is available to students in terms of assistive technology, so you can really make an informed decision on it, I don't know what is available in our district."

While this awareness is related to comfort with technology, it is definitely a distinct problem. Teachers who expressed comfort with technology often cited the need to have either an awareness themselves or someone on the team with an awareness of how assistive technology can help students. Teacher 4 talked about the need to have an awareness and knowledge of assistive technology and the ways it can be beneficial to students. "It depends on, you know, who you're working with and what their interest is. If they're really interested in that, they help a lot with that kind of thing. 'Cause we can't have all the knowledge of everything. That's why it's great to have people who know those things." Teacher 4 went on to say, "I don't think of it. I don't know if there's

something available that could help. I mean they could get by in a different way. I mean maybe something else would be far better for them, but when I don't have the knowledge of it..."

#### *Confirmation in the literature*

The literature pertaining to the competencies of a special educator's knowledge of assistive technology is "almost universally in agreement that the success of students with disabilities with AT is related directly to the AT knowledge, skills, and dispositions of special education teachers" (Michaels & McDermott, 2003, p. 29). In this literature review limited teacher knowledge as a barrier was categorized in the areas of teacher awareness and the attitude and acceptance level of teachers as they pertain to assistive technology.

#### *Teacher awareness*

As more students with disabilities are participating in full inclusive classrooms, in which they are expected to perform grade-level work but are not always given support, teachers are continually exploring ways to educate students with disabilities more effectively. Assistive technology is one of the tools and strategies that teachers can utilize, yet too many teachers are not cognizant of the potential of assistive technology to empower students who are struggling to work independently at their grade level (Hasselbring & Bausch, 2005). Based on the available literature, it appears that a teacher's knowledge or lack of knowledge regarding assistive technology could be classified as a significant barrier to the successful implementation of assistive technology.



Van Laarhoven et al. (2008) conducted a study which "involved evaluation of pre-service teachers' knowledge of, and comfort with, using AT and integrating a prototype computer-based DVD-Encyclopedia of AT (EAT) -into instruction" (p. 31).

A total of 188 pre-service special and elementary education teachers participated in the study at the Northern Illinois University (NIU) in 2006. The pre-service teachers in this study were all juniors or seniors and enrolled in one of the four targeted education courses.

An Encyclopedia of Assistive Technology (EAT) was prepared in DVD format to utilize in this study. This EAT contained tutorials comprised of "videos depicting software programs and/or devices that support individuals who have difficulties with written language, reading, math, communication, study skills, and/or physical control of their environment" (Van Laarhoven et al., 2008, p. 34). The students were required to watch the EAT DVD in class or in the assistive tech lab and complete the required components of each lesson. The goals of the study were to measure if the use of the EAT was an effective method for incorporating assistive technology into the teacher education program and "to determine if teacher candidates' familiarity, comfort level, and perceived effectiveness in AT improved as a result of using the tutorials" (p. 37). Teacher candidates were also asked to evaluate the EAT tutorials regarding their "satisfaction with using video based materials as an instructional tool" (p. 37).

To measure the effects of the EAT the teacher candidates were given a 40 statement field-tested survey as a pretest and posttest. On each statement the students were asked to rate their level of agreement using a 5-point scale. Four major subscales

were created to analyze the results from the survey. A second survey that was a 10-item rating scale was used to measure teacher candidates' satisfaction with the video tutorials. Three major subscales were used to analyze the results from the second survey.

The authors reported the results of the study (Van Laarhoven et al., 2008) using a partial eta-squared (as cited in Cohen, 1988) to measure the magnitude of growth from pretest to posttest. All of the results from the subscales showed significant pretest and posttest differences. The study results support the suggestion that a teacher's knowledge or awareness is a barrier to the effective use of assistive technology by a student with a disability. The personnel of this University, NIU, recognized a lack of experience or training with assistive technology as a deficit in their teacher education program and developed a resource to fill this void, with expectations to better prepare teachers to identify, implement, and evaluate the use of assistive technology with their students.

Bausch et al. (2008) conducted a study to "describe the current state of AT service delivery as reported by teachers in 14 states" (p. 3). A survey design was implemented in this study to collect data. The Status of AT Use Survey was developed by National Assistive Technology Research Institute (NATRI) researchers which "contained six sections that asked respondents to report data on student demographics, educational placement, AT use, AT services, related services, and AT documentation" (p. 4). The survey was available in a paper and online version.

The section of the survey pertaining to this Bausch et al. (2008) study was where respondents were asked to list the assistive technology services which their students received. Following the identification of services, respondents were asked to "indicate

whether the service was provided by a school system employee or a contracted professional" (p. 5).

A total of 699 surveys were completed from a variety of sources, including respondents from 14 states who were participating in a simultaneous NATRI study, six school districts, and attendees at various national conferences. The surveys completed reflected students with various disabilities, and 468 students were male, 225 students were female, with gender not identified in six surveys. The students were in grades preschool through twelfth. Of the 699 returned surveys, 110 respondents reported the student did not receive any assistive technology services. Since respondents could enter all services a student was receiving, there were 1468 assistive technology services recorded on the remaining 589 surveys.

The findings in this study by Bausch et al. (2008) rose "concerns about the lack of awareness among professional of what AT services are" (p. 11). While much effort has been made to "educate professionals about the nature of AT devices, successful implementation of technology depends on the provision of services" (p. 11). An alarming fact apparent from the findings in the study was 110 out of the 699 students were reported to be using assistive technology devices but they did not receive any assistive technology services. "Such a trend is alarming, because successful implementation of AT devices is not possible without the support of AT services" (p. 11). Assistive technology services are legally required to be documented in a student's Individual Education Plan (IEP). It is crucial that educators are knowledgeable of the requirement to consider appropriate services along with the devices during the IEP process. This lack of awareness may

interfere with assistive technology services delivery and successful implementation.

Assistive technology must be documented in the IEP but this cannot happen if the IEP team members are unaware of assistive technology devices and services (Bausch et al., 2008).

The implications of the Bausch et al. (2008) study have an important message for both professionals working with students with disabilities and for teacher education preparation programs. The obstacle of limited knowledge pertaining to assistive technology services must be overcome and solutions determined to eliminate teacher knowledge as a significant barrier to effective utilization of assistive technology.

In the case study by Hutinger et al. (1996), as discussed previously a lack of training regarding assistive technology is identified as a barrier. Teachers may know that assistive technology should be considered for a child as part of the Individuals with Disabilities Education Improvement Act of 2004 (IDEIA, 2004), but being able to implement assistive technology into daily schedules and the curriculum necessitates a unique set of skills. Training for teachers on different technologies and strategies to integrate those technologies into the curriculum would have the potential to impact children's learning. Many teachers who do not use technology to its full extent identify lack of time and lack of awareness of training opportunities as the cause.

A study conducted by Michaels and McDermott (2003) was designed to measure the level of integration of assistive technology into curriculum and instruction of special education teacher preparation programs. A survey was designed to collect the desired data. The authors' two research questions in this descriptive study were "how are

knowledge, skills, and dispositions related to AT currently integrated within special education teacher preparation programs; and how should knowledge, skills, and dispositions related to AT ideally be integrated within special education teacher preparation programs" (p. 30). The respondents to this survey were program coordinators of graduate special education teacher preparation programs across the country. Surveys were mailed to 356 program coordinators. The survey instrument, Special Education Teacher Preparation Survey, was developed to collect both quantitative and qualitative data. The survey was divided into three major sections. The first section was to report demographic information. The second section consisted of two 7-point Likert scales, which share the same 22 items. The first 7-point scale measured the "current attainment level or the degree to which the item was currently being addressed with their special education teacher preparation program"(p. 31) and the second 7- point scale pertained to attitude and acceptance levels of special education teachers and will be discussed later in this section. The final section of the survey was to gather narrative answers to these two open-ended statements: "Describe how AT knowledge, skills, and dispositions were currently addressed within their special education graduate program" and "Describe any planned future changes, or enhancements to promote AT knowledge, skills, and dispositions" (p.31). These three components or factors associated with assistive technology competencies were addressed in this survey: understanding of assistive technology; using assistive technology; and making assistive technology decisions.

There were 356 surveys mailed to respondents and 143 of these surveys were returned for a 40 percent response rate (Michaels & McDermott, 2003). The respondents

were 66 % female, white, middle aged, and had been employed in their jobs approximately ten years on average. The data reported by respondents when asked to describe their current level of assistive technology knowledge was 57 % intermediate, 24% novice, and 5% no experience. The analyses of quantitative data on the survey pertaining to "the degree to which AT competencies are currently integrated and addressed within graduate special education teacher preparation programs" (p. 33) can best be interpreted as minimal or not at an acceptable level of attainment. Special education teacher preparation programs must increase "capacity, resources, and faculty expertise so they can effectively integrate AT competencies into curriculum and instruction to assure their graduates leave their teacher education programs with the knowledge, skills, and dispositions necessary to address the AT needs of their students" (pp. 38-39).

Michael's and McDermott's (2003) recommendations will need to be considered by many teacher education preparation programs if the goal is to ensure all teachers of students with disabilities are competent in their knowledge of assistive technology devices and services. This will be "especially critical as new technologies are developed that hold great promise for improving the independence, productivity, and full participation of people with disabilities in school and society" (p. 39).

Puckett (2004) reported on a project to develop an assistive technology toolkit for special education teachers. The project was called Accessing Curriculum Content for Special Education Students (ACCESS) and was conducted with thirty-one K-8 special education teachers. The teachers were from thirteen schools in five different districts.

A survey, which yielded results of particular concern, was completed by the participants prior to the start of the intervention, of an on-line training. The survey indicated, "Extremely low levels of knowledge and use of assistive technology reported prior to the project activities" (p. 10). The results of this study supported the claim of low level of teacher awareness concerning assistive technology is a barrier to students' effective use of assistive technology. The beginning level of knowledge for teachers of students with disabilities can hinder the students' access to the general education curriculum.

Thompson et al. (2000) stated, "Special educators who are expert problem solvers rely on a variety of tools and strategies, including assistive technology in their work" (p. 12). The authors acknowledged assistive technology is not the answer to every challenge that students with disabilities encounter; however, special educators who have "little knowledge and/or limited access to them are at risk of becoming ineffective" (p.12).

Special educators who do not possess current knowledge of assistive technology are at a disadvantage to "participate meaningfully in solving certain types of problems" (p. 12). The authors gave the example of a teacher who is unaware of computer screen magnification technology would see no value in introducing a student with a severe visual impairment to the advantages a computer could provide. "The uninformed teacher may reason that devoting time and energy to teaching computer skills to a child who cannot see the screen or the keyboard would be as futile as enrolling the child in a behind the wheel driver education course" (p. 12). The lack of computer skills may limit this child's opportunities for future learning.

Thompson et al. (2000) did not put all the responsibility of the lack of assistive technology knowledge on teachers. They suggested "local school districts, state education systems, and the federal government could certainly have done more to provide opportunities for teachers to upgrade their skills" (p.13) along with teacher preparation programs and the individual teacher.

Illinois State University (ISU) engaged in an initiative to improve the assistive technology knowledge of special education teachers. At the beginning of this initiative a survey was created to "determine (a) the extent to which they perceived that their students had unmet needs for AT, (b) what they perceived to be their needs for AT competencies and training, (c) what features they would like to have incorporated into a regional AT Center, and (d) how they would like to have AT training provided" (p. 13). The information gathered in response to section (b) what they perceived to be their needs for AT competencies and training, is significant.

The survey was mailed to 234 special educators employed by three administrative units close to the ISU campus: "(a) the University's two laboratory schools; (b) a special education association that serves 17 rural school districts; and (c) a special education association that primarily serves students who live within the boundaries of a mid-sized city" (Thompson et al., 2000, p. 13). ISU had 149 surveys returned for a 64% response rate. The special educators were given a list of seven barriers and asked to "assess the extent to which each of the barriers had an actual impact on service provision" (p. 15).

The results of this assessment were equally distributed. The barrier "A lack of knowledge about the potential of assistive technologies to benefit students among school



personnel" (p. 16) had 45% of respondents indicating it was a legitimate barrier and 19% indicating it was a major barrier, the highest percentages reported on any of the potential barriers.

The special educators also were asked to assess their general competence in assistive technology. Seven percent of respondents were very competent, 56% some competence, and 37% reported they lacked basic competence. Thompson et al. (2000) stated the data, "suggests a great need for additional pre-service and in-service training of teachers in assistive technology" (p. 17). The authors emphasized: "It is not a challenge, but rather a morale mandate, that we determine students' needs for AT and prepare our teachers to respond to them" (p. 21).

Even though this survey was specific to the region around ISU, it does support the claim that lack of teachers' knowledge is a significant barrier to effective utilization of assistive technology by a student with a disability. ISU recognized the void of knowledge pertaining to assistive technology in their special education teacher preparation program and initiated a process to eliminate this barrier, which many other universities could replicate.

A study by Lee and Vega (2005), as discussed earlier in this literature review, was designed to "assess perceived knowledge, attitudes, and challenges of assistive technology use by special education teachers in California" (p. 60). This was a survey of four multiple-choice questions, 15 open-ended items, and 20 Likert-scale items which was distributed to 599 special education personnel in a mostly rural county with a high migrant population in California. The data collected reflected the largest barrier to

assistive technology use was a lack of knowledge or awareness (N = 58; 41%) by teachers. The authors included several quotes from the respondents in their study: "The challenges/barriers were learning how to use the devices; knowledge of possible AT beyond academic skill development; I am not aware of what other AT is available; and lack of knowledge on my part" (p. 61).

Judge and Simms (2009) conducted a descriptive study of special education teacher preparation programs to analyze the current practice of assistive technology course delivery for the preparation of special educators. The authors identified 375 publicly funded institutions offering special education teacher preparation programs. They narrowed their search to 160 preparation programs which represented urban, suburban, and rural areas from across the United States. "Of the 160 postsecondary institutions sampled, there were 819 different programs offered at the undergraduate, initial licensure post baccalaureate, and master's degree level" (p. 37). The results of this study revealed interesting data. "Of the 185 different undergraduate licensure programs offered, 34.6% mandate an AT course for degree and licensure requirements" (p. 38).

Three hundred sixteen postsecondary institutions offered a special education initial certification program for students already holding an undergraduate degree. Of these 316 "programs offered, 28% mandated an AT course for initial licensure requirements" (p. 38). Approximately 96% of the 819 programs offered a master's degree in special education. Of the master's programs 24.1% mandated an assistive technology course for degree requirements. Only two degree programs required students to complete two courses pertaining to assistive technology. Data from Judge and Sims (2009)

suggested that if assistive technology coursework was required in a special education licensure program, such coursework typically involved only one assistive technology course.

These findings seemed to indicate a lack of assistive technology training at the preservice level (Judge & Sims, 2009).

Limitations were identified in this study which would need to be considered before generalization could happen. This study by Judge and Simms (2009) seems to support the claim that lack of a teacher's awareness or knowledge can be a barrier to a student receiving appropriate assistive technology services and devices thereby hindering the student's progress.

Hanline (2010) conducted a qualitative study with 15 early childhood special education (ECSE) pre-service teachers in Florida to acquire insight to the relationship of the "conceptual and theoretical knowledge gained in the academic classroom to the realities of providing early intervention services" (p. 349). The 15 teachers were female.

One was African American, one Hispanic, and 13 Caucasian. All 15 participants had progressed through an accredited (National Council for Accreditation of Teacher Education) special education initial teacher certification program. This program included one class pertaining to assistive technology entitled "Introduction to Special Education Technology" (Hanline, p. 338). "When participating in the field experience for the purpose of this study, the pre-service teachers were in their first year of a combined junior-senior initial teacher preparation program, but data were not analyzed until each participant graduated (Hanline, p.336). All 15 pre-service teachers were placed with

appropriately certified cooperating teachers in one of seven preschool "settings that included in the same classroom 3- to 5- year olds who were typically developing, at risk, or identified as having disabilities and/or developmental delays" (p. 336). The participants were required to complete all the components of teaching in an inclusive preschool special education classroom. "In addition, they were required to submit weekly reflective journals, participate in bimonthly seminars, and evaluate the course at the end of the semester" (Hanline, p. 338). The participants were each individually observed three times for an hour each time. Following the observation, the university supervisor would provide oral and written feedback.

The data collected were the weekly reflective journal entries, the questions asked or experiences shared during observations, and the final reflection regarding the level of supervision they were provided. Out of the 182 completed journal entries from a possible 195 entries, 135 questions were asked, 42 experiences were shared, and 15 comments during the final reflection were the data coded and analyzed. Hanline (2010) used the Department of Early Childhood (DEC) recommended practice strands in early intervention/ECSE as a starter list of codes. These direct strands included: assessment; child-focused practices; family-based practices; interdisciplinary models; and technology applications.

The one significant piece of information from the Hanline (2010) study that pertains to this study is absence of data to be coded into the DEC strand of technological applications. "In this study, pre-service teachers wrote and spoke *minimally* about technology applications and interdisciplinary models (both direct service strands) having

had little experience with either in their field experiences" (p. 348). DEC supports the personnel preparation recommended practices that "students need opportunities to practice research-based instructional strategies with individuals, small groups, and large groups in the service site" (Miller, Ostrosky et al., 2003, p.113, as cited in Hanline, 2010). These pre-service teachers did not have an opportunity to practice with assistive technology, creating a void in the pre-service teachers' application of knowledge pertaining to assistive technology. Hanline (2010) reported "It is critical that the ECSE personnel programs continue to strive to provide field experiences that mirror the breadth and depth of the role of the ECSE professional" (p. 348). Implementing necessary and effective assistive technology services to preschool students with disabilities would qualify as a role of the ECSE professional.

A field experience is an "opportunity for pre-service teachers to connect the conceptual and theoretical knowledge gained in the academic classroom to the realities of providing early intervention services" (p. 349). The lack of data to be categorized in the DEC strand of technological applications reflects the lack of conceptual and theoretical knowledge gained in the academic classroom pertaining to technology applications, including assistive technology, which can be applied to the realities of providing early intervention services. The implications from this Hanline (2010) study support the claim that some teachers lack the training to supply the necessary and effective assistive technology devices and services to student with disabilities.

The Arc study reported by Wehmeyer (1999) as discussed earlier in this literature review, identified cost as the number one barrier of assistive technology, but found a

teacher's deficit of information or a lack of knowledge pertaining to assistive technology as the second most identified barrier.

These results, in conjunction with findings from Derer and colleagues, suggest that tech is generally perceived to be beneficial but barriers like funding and lack of information fail to bridge the gap between the promise of assistive technology articulated in the Tech Act and reality of identifying, obtaining, and using such devices...The challenge for districts, teachers, families, governmental bodies alike will be to find creative ways to make the promise a reality. (p. 55)

Nelson (2006) conveys the idea that educational needs of P-12 students are at the center of the Interstate New Teacher Assessment and Support Consortium (INTASC) standards and the National Council for Accreditation of Teacher Education (NCATE) guidelines. INTASC standards make "specific reference to diverse learners, the use of technology, and the availability of a variety of materials, approaches, and opportunities to demonstrate knowledge for P-12 students" (p. 486). In response to meeting these educational needs of P-12 students, Nelson (2006) stated "The knowledge, disposition, and teaching performance or skills needed to embed AT in teaching and learning should be a necessary and beneficial part of meeting the standards for all teacher candidates" (p. 496). Although, he recognized these components of knowledge, disposition, and teaching performance or skills as related to assistive technology are not always present to embed assistive technology into instruction for students with disabilities. Nelson (2006) quoted these 1999-2000 statistics from the U.S. Department of Education:

87.5% of students with speech or language impairments, 45.3% of students with specific learning disabilities, 25.8% of students with emotional disturbance, 14.1% of students with mental retardation, and 11.2% of students with multiple disabilities were served outside the regular classroom less than 21% of the school day. (p. 486)

These statistics reflect the fact that students with disabilities are in the general education classroom 79% or more of their day. Many of these students may benefit from the use of an assistive technology device and teachers and teacher candidates "need to be prepared to recommend and utilize innovative technologies which bridge many of the learning gaps for students with special needs" (Nelson; 2006, p. 486). Nelson (2006) acknowledged that teacher education programs today needed to reform and include a background of a range of assistive technology devices and services, legal parameters of the provision and use of assistive technology, and consideration of assistive technology in the IEP process. These statements reflect the claim that teachers lack the training to supply the necessary and effective assistive technology devices and services to meet the needs of their students with disabilities.

The assessment or screening of an individual to match an individual with the most beneficial assistive technology device was an important part of the reauthorization of IDEA (1997). If the screening is appropriate and adequate, it will be a crucial support tool in the path to greater independence and integration into the world for a student with disabilities. If the special education teacher does not have the knowledge to conduct this

screening, or has resistance to initiating this screening, the assessment becomes a barrier to successful implementation of assistive technology to students with disabilities.

Beigel (2000) identified the concept the learner's strengths and abilities must be kept as the overarching objective during the assessment phase. The strengths and abilities must to be used "to ameliorate potential difficulties in the classroom" (p. 239). He cautioned it is easy to get absorbed in extravagant assistive technology devices and lose focus on determining what "strengths the learner has and how the use of AT might enhance these strengths to enhance the educational outcomes for the learner" (p. 239). Beigel (2000) broke the assessment process down into three strands: the learners, their environment, and the technology. He stated the three strands are directly connected in the following way: "The learner must use the device in many environments. Failure to consider any one of these areas may lead to a failed evaluation, as the device prescribed may be abandoned" (p. 239). The teacher is the key component in all three of these strands. If the teacher is unaware of all the details that configure these three strands the teacher would be considered the barrier in the assessment process.

Beigel (2000) stated the learner's personal style and the learner's physical strengths and needs are the two general areas pertaining to the individual action of a learner abandoning a device. Determining, or screening for, the learner's personal style involves spending substantial time with the learner to explore their preference of the device. He identified a set of questions for each of the three strands of the assessment process. He stated the following questions needed to be addressed with the learner at the beginning of the assessment process:



- (a) What purposeful motoric movement does the individual have;
- (b) How willing is the learner in trying new activities or tasks;
- (c) What does the learner desire from the use of AT;
- (d) What supports will the learner require in using the device;
- (e) What level of training will the Learner and others who interact with the learner need; and
- (f) (f) What impact will the learner's socioeconomic status and cultural background have on the use of AT? (p. 240)

In the second strand, the environment, Beigel (2000) identified questions regarding how the teachers present information to learners, what is the preferred learning style, what type of assessment is used, and what is the teacher's level of receptiveness of a student utilizing assistive technology in the classroom. The physical structure of the classroom was also explored.

Beigel (2000) cautioned that the third strand, the device, should only be scrutinized after examining the learner and the environment. Beigel (2000) offered questions for examining the device and checking for durability, for ease of repair, and for portability of the assistive technology.

Beigel (2000) discussed each of the questions in detail reiterating the importance of the teacher's role in the assessment phase to select the assistive technology device which will enhance the interactions and learning and "allow learners to use their strengths and participate as fully as possible in the school" (p. 239).

Beigel's (2000) questions are very similar to Zabala's et al. (2000) Student, Environment, Tasks, and assistive Technology tools (SETT) framework. The SETT framework provides broad questions that help Individual Education Plan teams to focus on individual student needs in multiple environments.

Abner and Lahm (2002) conducted a study using a census survey to identify teachers' lack of training. This survey was mailed to all teachers of students with visual impairments in Kentucky. Of the 145 surveys mailed out 72 were from which data were collected. Sixty eight of these 72 respondents were certified teachers of students with visual impairments; the other four were currently enrolled in a certification training program.

Abner and Lahm (2002) cited this statement from the International Society of Technology in Education, (2000): "A critical factor in students' use of technology is their teachers' technological knowledge and skills" (p. 101). A majority of teachers (51%) in this study felt they were at the apprentice or lower level for teaching their students regarding assistive technology. When the teachers in Abner and Lahm's (2002) study were asked if they felt they needed more training in assistive technology, 70 of the 72 (99%) responded with a "yes" answer. The authors summarized their finding with this statement: "On the basis of these findings, it is clear that university training and other professional development programs should address competence in higher-level technology" (p. 104) knowledge and skills for teachers of students with disabilities.

This study strengthens the argument that a teacher's knowledge or lack of knowledge regarding assistive technology could be identified as a significant barrier to

the successful implementation of assistive technology. This deficit of knowledge will impact a teacher's ability to screen students for assistive technology devices and services.

Complicating the knowledge barrier are attitudinal and acceptability factors also restricting the successful implementation of assistive technology. In addition, teachers do not know there are attitude and acceptance issues. The level of knowledge may also hinder the attitude and acceptance level of assistive technology by a teacher which will be reflected as a barrier to successful implementation of assistive technology.

#### *Attitude and acceptance*

A study conducted by Maushak, Kelley, and Blodgett (2001) supported the statement that teachers' attitudes and acceptance levels could be barriers to use of assistive technology by a student with disabilities. This study involved 168 students enrolled in a computer applications class for elementary teachers. A 20- question survey was "designed to measure students' knowledge of and attitudes toward assistive technology and students with disabilities"(p. 270). The participants used a six- item Likert scale as a response set. Participants were asked to indicate if they had any of the following three variables: (a) completed the required diversity course; (b) had a family member who is disabled; or (c) had a close friend who is disabled. This study used a pre-post-survey design format with 168 students completing the pre-survey and 154 students completing the post-survey. The age range of the students was from 19 to 44 years with an average age of 21.3 and 85% of the participants were females.

A mini workshop on assistive technology was presented to the student participants between the pre-survey and the post-survey. The data collected in the study

by Maushak et al. (2001) were analyzed three ways. The pre-survey frequencies were studied "to identify current attitude and knowledge and identify areas of concern" (p. 270). The data was then reviewed for the post-survey to check "if the same areas of concern held true after participants completed the mini-workshop" (p. 270). The third way data was analyzed was to compare the mean scores of the pre- and post-survey to detect any differences in the "attitudes and knowledge based on independent variables: diversity class, disabled friend, and disabled family member" (p. 270). The results of the study reflected varying attitudes of the pre-service teachers towards acceptance of students with disabilities and their use of assistive technology as an access to the general education curriculum and setting. One area of concern was almost three-fourths of the participants felt students with disabilities should be in a special school. Another troubling result from this study was that "over one-third felt that children in a traditional classroom would be uncomfortable with a disabled child and that disabled children feel sorry for themselves" (p. 273). Even the students who had completed the diversity class communicated these feelings in their survey results. The students' survey results indicated that students did have at least an awareness of assistive technology but they did not feel it was an acceptable intervention for students with disabilities to participate in the general education environment.

The impact of the mini workshop did not foster a change in attitude but it did increase the knowledge level pertaining to assistive technology (Maushak et al., 2001). These results support the need for the inclusion of assistive technology to be immersed in the teacher education preparation program. The results also suggest the content of the

diversity class be restructured to raise the awareness and acceptance of students with disabilities in all environments. This study supports the statement that a teacher's attitude and acceptance level can have an impact on how well assistive technology is identified and implemented for a student with disabilities.

Michaels and McDermott (2003), in a study referenced earlier, used Likert scales to measure data from teachers of students with disabilities. The second 7-point scale "asked respondents to consider the importance or how critical they believed that knowledge, skills, and dispositions related to that item would be for special education teachers in relation to promoting the full citizenship of students with disabilities" (p. 31). Statistically significant and substantially meaningful differences between the perceived current attainment and importance of assistive technology integration were reported in this study. These "differences between the perceived current attainment and importance of this AT integration would seem to indicate that many current graduates are leaving graduate special education teacher preparation programs without these critical AT competencies" (p. 39).

Michaels and McDermott (2003) reported some of the graduate programs in special education included in this study commented that assistive technology knowledge, skills, and dispositions were not necessary in their programs as they were preparing educators to work with students with mild or higher incidence disabilities. Michaels and McDermott (2003) cited National Association of State Directors of Special Education (2002) and Research Connections (1998) as a rebuttal of this statement:

Evidence indicates that the successful inclusion of students with mild or high incidence disabilities and their ability to access the general curriculum and demonstrate mastery of the ever-increasing state and national learning standards may be directly related to effective AT integration in the programmatic preparation and instruction of special education teachers at the pre-service level. (p.39)

A study by Lee and Vega (2005), as discussed earlier in this literature review, was designed to "assess perceived knowledge, attitudes, and challenges of assistive technology use by special education teachers in California,' (p. 60). This was a survey of 4 multiple-choice questions, 15 open-ended items, and 20 Likert-scale items distributed to 599 special education personnel in a mostly rural county with a high migrant population in California. The results indicated that teachers who reported receiving more training hours pertaining to assistive technology also had a higher acceptance level of students with disabilities using assistive technology and the importance of assistive technology.

The teacher plays a critical role in the success or failure that assistive technology can play in the life of a student with disabilities. Early childhood and elementary teachers play a critical role to provide assistive technology devices and services at an early age. Early implementation of assistive technology has shown to influence children's attainment of developmental skills (Parette & Stoner, 2008). Individual education program (IEP) team members are mandated under IDEA (2004) to consider assistive technology for every student when developing IEPs. The research reviewed in this section confirms that teachers at all levels are generally unaware of assistive technology

devices and services or may possess attitudinal or acceptability perspectives limiting the consideration or provision of assistive technology devices. When teachers are not accepting of most assistive technology devices and services available for students with disabilities, it may lead to the lack of consideration of assistive technology which in turn prohibits the achievement of this IDEA stipulation. Clearly the teacher's limited knowledge of assistive technology and/or attitude regarding assistive technology are barriers to effective assistive technology use for students with disabilities as previously claimed.

#### *School and District Support*

Assistive technology support varies widely from school to school and district to district, and yet school and district support is also vitally important. The school that Teacher 1 works at has an assistive technology Specialist and an assistive technology Lending Library, where teachers can try different types of assistive technology for their students without the need to actually purchase the equipment. If a particular piece of technology proves effective for a student, it can then be incorporated into the IEP with confidence. And the assistive technology Specialist is available to make recommendations to teachers that may prove effective for their students, so even those teachers who are not very aware of what is available have a resource to ensure they are providing the best services possible to their students. It should be noted that Teacher 1 had the highest percentage of students with assistive technology on their IEP.

Teacher 1's school and district stand in direct contrast to those of Teacher 6. Teacher 6 says "I've never received anything from my district on assistive technology.

And I work for a fabulous district, but I've never received anything in term of this is how we support your students. This is when we should be considered. This is, um, who your contact person is and why you'd want to connect with them." Teacher 6 had less than 5% of her students with assistive technology on their IEP.

### *Cost*

One subject that was discussed in mostly veiled terms and made the teachers most uncomfortable was the subject of cost. When asked about potential barriers, several of the teachers hedged their answers, while tacitly acknowledging that cost was a factor. One teacher was fairly blunt. Teacher 4, speaking of cost considerations, says, "I would guess that's a huge one too because the district doesn't have the money so that's why we need to be cautious too about what we're thinking because if there's no money, we don't want to be bringing it up and, you know, giving hope to parents when there isn't anything available."

The issue of cost seemed only to apply to technology, not to other recommendations on the IEP. For example, this exchange with Teacher 6 shows this double standard:

Um, and what would, what would you need to do, What would you need to happen for you to recommend that and what would keep you from recommending-

**Teacher 6:** Um, it would have to, um, In all honesty, where I work, it would have to go through our program coordinator first. Who kind of gets to make that



decision. So kind of the argument for that and how it would work for the student would have to go there first. It could never just be presented at an IEP meeting.

**Interviewer:** OK.

**Teacher 6:** Because I'm sure there'd be a financial cost to that. So, um, that's where it would have to go.

...

**Interviewer:** ... You say, "Hey, um, we have a student who's got a cognitive disability and we want to do applied behavior therapy to take that approach.

Would that have to go through your program coordinator?

...

**Interviewer:** ... Here's the approach we're gonna take. We're going to, I've got this idea. ... We're going to have, you know, a picture schedule up on the wall for this student. Does that kind of stuff have to go through the

**Teacher 6:** No, that stuff doesn't have to go through. That can be, um, that would really be up to the teacher in the room who knows the student. Um, It would be based on their need which hopefully would come up for evaluation or years of experience and that would be discussed, you know, within an IEP meeting or a call home to parents, you know

...

**Interviewer:** But if you said I have a student who, I have an autistic student who has this software application that helps him pay attention to facial cues and helps people better read the facial cues? You'd have to go to the program director.

**Teacher 6:** Um, If we owned the software? No.

**Interviewer:** If you were aware of it.

**Teacher 6:** If you were aware of it. Yah.

**Interviewer:** But if it costs money?

**Teacher 6:** Um. But if it costs money, we, it have to, um, it has to go through our program coordinator who oversees our budget.

**Interviewer:** OK. So anything that costs money has to go through the program coordinator?

**Teacher 6:** Yah. Yah. And, yah, we've been very fortunate to have a pretty good budget. Because we're a new program and developing. Um. But, yah, yah, everything it has to go through her. For approval.

This exchange shows that cost is a very real factor in assistive technology considerations. Further, when it comes to assistive technology, administrators are not just relying on the experience of the teacher, but are directly involved in the decision as to what is appropriate for the student and what is not. Since parents almost exclusively rely on the teachers to make recommendations regarding assistive technology, budget constraints have a real impact on what assistive technology parents are even allowed to consider.

### *Confirmation in the Literature*

When teachers were first required to look at assistive technology services for students with disabilities, many were concerned that the cost of assistive technology was a barrier. However, these concerns may have decreased recently due to greater affordability and yet recent data regarding cost are not available (D. L. Edybum, personal communication, November 21, 2011). Further some scholars propose that cost is a greater restriction today than it was a decade ago (K. Higgins, personal communication, November 21, 2011). It is difficult to conclude whether cost is a prohibitive factor or if the provision of assistive technology to students with disabilities is more affordable today. In this literature review financial barriers will be discussed in terms of purchasing, maintaining and repairing assistive technology devices and the cost of providing assistive technology services.

Derer et al. (1996) initiated a project, The Analysis of Technology Assistance for Children (ATAC), to address the absence of information pertaining to current practices of assistive technology. Within this project they developed a survey and distributed it to special education classrooms across three states: Indiana, Kentucky, and Tennessee. This survey was developed and refined using previous questionnaires from the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) and Tennessee Department of Human Services, periodicals, and assistive technology textbooks. The final version of this survey was narrowed to 75 items including "13 items related to the demographics about respondents and characteristics of their students using assistive technology, two open-ended items asking respondents to identify the barriers

and benefits of using assistive technology, and a set of 63 items that requested information on the number of students using different types of assistive technology devices in various settings" (Derer et al., 1996, p. 2). A total of 1266 surveys were distributed to districts that were actively providing assistive technology services. Of these 1266 surveys sent, 405 were returned for a 32 percent return rate. Information regarding barriers was identified from responses to the first open-ended question on the survey.

The results were analyzed and coded with a scoring taxonomy. "By far the most frequently mentioned barrier involved monetary concerns"(p. 5). Expense and lack of funds were two identified sub-themes within monetary concerns reported by special educators. Expense referred to "expense of acquiring equipment related to the fees, cost, and price of hardware and software" (p. 5). The lack of funds was identified as "access to an adequate money supply for purchasing equipment, training, or personnel" (p. 5).

Accurate assessment and knowledge of the assistive technology continuum provides the basis for making cost-effective assistive technology decisions (Beard et al., 2011). "For students who are eligible for special education services under one of the 13 disability categories defined by the Individuals with Disabilities Education Act, it is the responsibility of the local school district to pay for any AT device or service included in the student's IEP" (Beard et al., 2011, p. 12). Outside funding is usually necessary but limited and difficult to secure for the required assistive technology devices.

Wehmeyer (1999) discussed assistive technology barriers identified in the study completed by The Arc. The Arc created the Assistive Technology Use Survey and mailed it to 5,400 randomly selected members of The Arc who had a family member with mental

retardation. The survey was designed to be completed by a parent or caregiver. A response rate of 33% was achieved equaling 1,802 completed surveys returned. "The sample included 516 family members (or other adults knowledgeable about the assistive technology use of someone with mental retardation) from 45 states and the District of Columbia who returned completed surveys" (p. 49). The range of age for these students was from 1 to 21 years with a mean age of 11.84. There were 314 males, 200 females, and two surveys did not have the gender section completed.

Forty-eight respondents indicated that their family member lived elsewhere including with another parent (n = 4), in a foster home (n = 1), in a supervised group home (n = 13), with another relative (n = 6). Eighteen respondents indicated that their family member resided outside the family home, but didn't identify that location or listed "other," and 4 respondents didn't indicate where their family member resided. (p. 50)

The final survey contained five areas of questions concentrating on the use of assistive technology for a specific purpose: (1) Mobility Technology Devices; (2) Hearing and Vision Technology Devices; (3) Communication Technology Devices; (4) Home Adaptations; and (5) Environmental Control and Independent Living Devices (Wehmeyer, 1999). Within each of these five areas, there were identical questions pertaining to the domain area. The researchers asked if the student with disabilities used a device and provided a list to pick the particular device. The survey contained one question each about the funding source, assessment before and after purchasing the device, and satisfaction rate.

The other area included on the survey was designed to collect information on the availability of a computer in their home, if the computer was specifically purchased for the student with a disability, the funding source of the computer, and the purpose or intent of the use of the computer. If the student with disabilities did not have a computer available, in any environment, the respondent was asked to determine if that student could benefit from the use of a computer and the relevant barriers to computer access.

In The Arc's study, the respondents identified cost as the number one barrier to use of an assistive technology device. Cost was the barrier reported on in 255 of the possible responses.

Wehmeyer (1999) compared the Derer et al. (1996) survey, discussed earlier in this literature review, to The Arc survey and determined the results were quite similar. Derer et al. identified one of his six barriers of assistive technology as fiscal restraints, including the high cost of devices and the lack of funds to access devices or service.

Financial barriers are a continuous problem in the area of assistive technology, "as data from both this survey and the Derer et al. study strongly support" (Wehmeyer, 1999, p.52). The contentious issue of who pays for the assistive technology often creates conflict between school districts, teachers, and parents. These participants will need to work together to resolve the barrier of cost as it pertains to assistive technology.

Stead (2009) identified cost as a barrier. Stead supports this with a discussion of legislative acts. He suggests the IDEA requirement that students with disabilities be educated with their non-disabled peers to the maximum extent possible is a "clear legal imperative to make assistive technology available" (p. 2). He also concurs "current laws,

in particular the Individuals with Disabilities Act (IDEA), require that most assistive technology devices be provided free of charge to students with disabilities, if the devices are necessary for their education" (p. 2). Stead (2009) argues that despite these legal implications, assistive technology remains underutilized in American public education.

He rationalizes his claim that cost is a barrier by lack of funding of legislative acts with this statement: "Another obstacle to the full utilization of assistive technology that cannot be overlooked is that neither the IDEA, nor the NCLB (No Child Left Behind Act) has been fully funded" (p. 2). This lack of funding has compromised the ability to provide assistive technology devices and services to students with disabilities who could benefit from these appropriate assistive technologies and it also enhances the reluctance to adopt technology that would require the purchase of new assistive technology equipment.

Lee and Vega (2005) designed a study to "assess perceived knowledge, attitudes, and challenges of assistive technology use by special education teachers in California" (p. 60). A survey of 4 multiple-choice questions, 15 open-ended items, and 20 Likert-scale items was distributed to 599 special education personnel in a mostly rural county with a high migrant population in California. This county has one of the largest school districts in the state and is also characterized by the lowest median income levels and highest unemployment levels in the state. Five hundred ninety-nine questionnaires were sent, and 154 valid responses were returned for a 26% return rate. Of these 154 responses, 23 (16%) respondents mentioned the funding issue. This could be attributed to being indirectly related to the lack of resources and materials, which was mentioned in 19% of the responses. In summary, "In times of tight budgets and economic hardship, this

(funding assistive technology) will continue to be one of the biggest challenges to assistive technology in special education classrooms" (p. 61).

Hasselbring and Glaser (2000) noted financial issues in school districts acted as substantial barriers to the incorporation of assistive technology. Schools are often hesitant to provide assistive technology, and teachers of students with disabilities must seek out alternative funding. To complicate funding as a barrier, Hasselbring and Glaser (2000) discussed the factor that assistive technology devices are often specific to an individual. Each individual's needs are different and unique requiring an individualized assistive technology device. This individualization drives the cost higher.

Hutinger et al. (1996) conducted a case study that analyzed how assistive technology was used in educational programs for 14 children with multiple disabilities. All 14 of these children had had two to ten years of prior assistive technology use and had received assistive technology intervention as a young child. All 14 of the children had regular access to assistive technology and all attended school in eleven districts in western Illinois which ranged in size from 60 to 7,960.

The authors used direct observation, videotapes of the children, questionnaires, and interviews with the teachers and parents to collect data. They also incorporated data pertaining to previous use of assistive technology to create a comprehensive picture of technology use and its impact. The investigators used a modified longitudinal approach which "permitted the study of changes in behavior, skills, and attitudes occurring in the children as they continued through school" (Hutinger et al., 1996, p. 16).



One of the barriers identified in this study by staff and family members was financial resources. Results from the study showed that limited finances negatively impacted technology use in the following ways: "(a) inadequate support services; (b) inadequate funding for media and materials; (c) inadequate classroom equipment; and (d) inadequate classroom staffing" (Hutinger et al., 1996, p. 31).

Respondents also referred to the hope and excitement of what their child could possibly accomplish based on the assistive technology assessment that was conducted. This hope did not last long as they also commented the process was long and the paperwork was endless with little results. Another monetary barrier reported in this study was when parents tried to secure funding for assistive technology from public agencies they did not get satisfactory results. One mother commented "I tried all last year through organizations with no success" (Hutinger, et al., 1996, p.31).

In a majority of empirical studies, financial matters were identified as a barrier. Korpela, Siirtola, and Koivikko (1992) conducted a study to "evaluate the costs of assistive devices regionally in a group of children with mobility limitations" (p. 597). Assistive technology devices for home, school, and day care settings were included in this study. The study took place in Finland with 201 children with motor limitations who lived at home and had assistive technology devices. The mean age of the students in the study group was 7.4 years of age. There were 89 girls and 112 boys.

The results of the Korpela et al. (1992) study revealed the children in this study utilized 1274 assistive devices which had a total cost of \$686,666. The results of this study led the authors to suggest "the assistive devices were relatively expensive

compared to incomes of Finnish families" (p. 601). The study did report the cost of the assistive devices was the most dependent on the "the severity of motor impairment and the age of the child" (p. 601). The inhibitive costs revealed in this study lend support to the claim of the cost of an assistive technology device can be a barrier to successful implementation of such devices.

The data reported and the findings discussed in this literature review outline the concept that costs of purchasing, training, and maintenance or repair of assistive technology devices are barriers to providing effective assistive technology to students with disabilities. This may no longer be an issue, they may be more affordable, however, recent data regarding costs are simply not available. In fact, some scholars may conclude that cost may be a bigger barrier than it was ten years ago. It is difficult to ascertain whether assistive technology is more affordable today than it was or if cost is still a factor.

### *Research Question Results*

It is important to use the above themes to help answer the original research questions. Each of the research questions is discussed below.

*How do parents of students with disabilities perceive the role of assistive technology in the success of their children?*

Parents perception of assistive technology was generally murky at best. Several parents had never heard the term, and those that had heard the term were unclear exactly what assistive technology encompassed. Further complicating the answer to this question

is the almost total reliance of parents on special education teachers to help them decide on what supports and interventions are appropriate for their children. Quite frankly, the parents interviewed did not even consider assistive technology as a tool to help their children succeed prior to having a teacher bring it up. Once it was brought up (or discussed during the interview for this study), the parents universally viewed it as another tool to level the playing field and help their children succeed. It is important to note that none of the parents felt it was essential to their child's success. During the interviews, those parents who had not heard of assistive technology were excited about assistive technology's possibilities, but had so little knowledge that they felt they would be unable to bring it up to their special education teachers.

*How do special education teachers perceive the role of assistive technology is in the success of their students?*

For teachers, the more comfortable they were with technology in general, and the more familiar they were with assistive technology solutions in particular, the more essential they felt it was to be seriously considered for every child. Those with limited technology background rarely if ever brought up assistive technology, relying on past assessments for any assistive technology recommendations. The teachers were also cautious about recommending assistive technology due to budgetary and support issues. Several teachers expressed the need to have the school team review anything before presenting it as an option to parents. Only the teachers who had access to a lending library of assistive technology were more likely to recommend a piece of assistive technology for their students on a trial basis. These teachers had a more positive view of

the role assistive technology played in the success of their students, and were more likely to recommend it.

*How do special education teachers perceive their role in integrating assistive technology within their classroom?*

In this area as well, a teacher's comfort with and knowledge of technology in general and assistive technology specifically largely shaped their view of their role. Those who were knowledgeable viewed their role in the process as vital, while those who were not as knowledgeable or comfortable tended to rely on someone else within the team or district. Teacher 3, whose technological ability was a self-rated negative 1, stated that he would rely on the district technology/assistive technology specialist when it came to recommending assistive technology. Later in the interview, he also stated that the only people who reviewed the recommendations on the IEP were those on the IEP team. The district assistive technology specialist was not on the IEP team. So, while teachers do see their role as vital, when they do not have the knowledge to make assistive technology recommendations, they really don't have resources in place to help them make recommendations.

*How do parents perceive their role in helping their children to use assistive technology?*

When it comes to helping children use assistive technology, parents view their role as being an advocate for their needs. If they feel it will help their children, parents will fight for it. When it comes to actually using assistive technology, parents' comfort with technology was a major factor in how they viewed their role helping their children. Families that had at least one parent who was technologically adept viewed that parent's

role as providing their children the technical help at home that they need. Families without a parent who was comfortable with technology would rely on the school for help. As Parent 1 put it, “I would start with the person who introduced it to us. Hopefully the special ed team has been highly trained to trouble-shoot any issues we might in utilizing it.” Clearly this is a big expectation for parents to have of teachers.

*How much support and assistance do parents and special education teachers feel they have in implementing assistive technology?*

The amount of support teachers (and subsequently parents) felt they had varied greatly from district to district and school to school. Teachers and parents from schools with large lending libraries and dedicated assistive technology staff felt very supported, and had higher implementation rates than those whose schools and districts had either no support or only district support. These teachers tended to have lower implementation rates of assistive technology.

*How well are parents and special education teachers communicating with each other about the assistive technology needs of the child?*

This communication tends to be one way if it happens at all. If teachers bring up assistive technology, the dialog is good, and parents are very supportive. However, in most of the cases, assistive technology is not talked about, and the only communication between teachers and parents is a check box on the IEP form. The teachers check that it’s been considered, and the parents accept that it was, and little to no conversation happens about it.

*What barriers to parents see in implementing assistive technology in their child's IEP?*

The major barrier for parents was the ability and recommendations of the special education teacher. All parents were reliant on the special education teacher for the recommendation. Some other minor barriers that parents thought might be a problem were student embarrassment at being different than their peers and financial considerations. Parents didn't view these as major obstacles, but as something they would figure out a way to overcome if they really felt the technology was important in helping their child. Curiously enough, all of the parents except 1 had experienced a resistance on the part of the school in getting their child put on an IEP in the first place. All of those children had cognitive disabilities such as FASD, autism, ADHD, or information processing disorders. The only parent who didn't experience this resistance had a child who had both a physical disability (visual impairment) as well as a cognitive disability (FASD). Clearly, this was a barrier to their children using assistive technology, but is part of a much bigger picture of barriers to accessing special education services in general.

*What barriers to special education teachers see in implementing assistive technology I their students' IEP?*

For teachers, there were three, interrelated barriers to their recommendation of assistive technology. Their comfort with technology was a large barrier, especially for those who felt technologically inept. Knowing that they would need to support anything they recommended, they were not likely to recommend anything that they didn't understand and that they couldn't support. Related to this is the teacher's general awareness of assistive technology that would be appropriate for their students. Both of

those barriers were mitigated in schools and districts that had exceptional support for assistive technology, especially when coupled with assistive technology lending libraries. For those whose schools and districts lacked support and/or lending libraries, this lack of support was an additional barrier that was difficult to overcome, especially for those teachers who lacked comfort with and knowledge of assistive technology. Cost was also a factor, although teachers were less open about this, speaking in mostly veiled terms about needing approval for any recommendation.

### Conclusion

All of this shows that the primary barriers to more widespread implementation of assistive technology all revolve around the special education teacher and their knowledge of and comfort with assistive technology. Even when teachers have the knowledge and comfort to make recommendations, cost can also become a barrier preventing teachers from recommending assistive technology for their students. Since parents are almost entirely reliant on teachers to make recommendations in general, and with assistive technology in particular, these barriers can be difficult to overcome.

## CHAPTER FIVE – DISCUSSION AND RECMOMENDATIONS

### A Theory of Parental and Teacher Perspectives on assistive technology?

#### *Introduction*

Five prominent themes emerged from the data that represent parental and teacher perspectives on assistive technology. These themes were:

1. Parents are almost entirely reliant on special education teachers for their perspective on assistive technology.
2. A teacher's comfort level with technology has the most profound impact on their perspective on assistive technology and their likelihood of adopting it.
3. A teacher's awareness of the ways assistive technology can be used to help their students is the major factor relating to their likelihood of recommending assistive technology for their students.
4. Support at the school or district level can be a factor enabling teachers to more frequently recommend assistive technology for their students.
5. For teachers, cost is a shadow factor that influences/limits their ability to recommend assistive technology for their students.

Together, these five themes form a beginnings of a theory about the conditions that influence the adoption of assistive technology. While this is not a complete theory, it does help lay the groundwork for further study. Theme 1 is an important influencer in that it points to the main factors enabling or inhibiting assistive technology adoption. The adoption of assistive technology is enabled through themes 2, 3, and 4. Theme 5 becomes



a limiting factor that can serve to cap the adoption of assistive technology. Themes 2, 3, 4, and 5 can be considered Factors that enable or inhibit the adoption of assistive technology on a student's IEP.

### *Explanation*

#### *Teacher's comfort level with technology*

All of these factors are important to consider as a whole and in the sequence listed to fully understand and predict the likelihood of assistive technology being implemented or even considered on a student's IEP. Specifically, a teacher's comfort level with technology, awareness of assistive technology solutions, and support from their school or district are primary drivers behind their selection of assistive technology for their students, made even more pronounced by parents' nearly total reliance on teachers to recommend assistive technology for their children. Budgetary constraints can be limiting factors in assistive technology implementation.

For teachers who are not comfortable with technology in general, the idea of adding technology to one of their student's IEPs is daunting, and something they are unlikely to do. This is because they perceive (often rightly so) that they will need to provide support and instruction for anything they include in the IEP. This is especially true given that teachers are aware of how much parents rely on them for all of their child's special educational needs.

Even for teachers who are technically savvy, a general lack of awareness of what assistive technology is available and appropriate can be an issue. While these teachers are not afraid of recommending technology per se, they certainly cannot recommend

solutions they don't know exist. Instead, they tend to rely on solutions that have been time tested and proven at least somewhat effective. This tends to preclude much assistive technology.

For teachers lucky enough to work in a school or district with an extensive assistive technology lending library and support staff, these supports can make all the difference in overcoming any deficiency in the first two factors. Teachers not technically adept can call on the assistive technology specialist to make recommendations and provide training and tech support. For the more technically savvy teachers, a lending library allows them to see and try multiple solutions before making a formal recommendation.

#### *Cost*

No matter how technically savvy or assistive technology aware a teacher may be, overcoming the high cost of assistive technology can become a serious factor in making an assistive technology recommendation. While IDEA was written without regard for budgets, the reality is that special education services are already expensive and underfunded. IDEA only provides for funding of up to 40% of the additional cost of providing special education services to students, and the actual federal funding levels are generally much lower than that. The additional funds to cover the remainder of the cost need to come from the general education fund.

#### Discussion

The findings in this study have implications for both future research and practice regarding teacher preparation, school and district support, and funding for assistive

technology. It is also important to recognize the limitations of this study. Each of these items are discussed below.

### *Limitations of This Study*

This study was designed to uncover themes rather than measure impact. Therefore, while these themes are certainly important, this study cannot address how to prioritize the suggestions that come out of trying to address the factors preventing assistive technology adoption. It should also be noted that this study involved only parents and teachers in school districts located primarily in the Minneapolis/St. Paul metropolitan area of Minnesota. Other themes may emerge in different parts of the country or world. For this reason, a solid theory was not developed. Rather, the initial ground work was laid for further research and further theory development.

### *Implications for Research*

One of the important implications of this study is that assistive technology adoptions requires a contextual approach that takes into consideration the mix of factors identified in this study. A systemic view of how each of these factors influence the rate of assistive technology adoption is critical. The reasons why certain teachers have higher rates of assistive technology adoption are intertwined among these factors, each exerting varying degrees of importance. Further, due to the limitations discussed above, studies similar in nature to this one should be repeated in different parts of the country to see if similar themes emerged, and to potentially uncover additional themes.

For this study, I found common factors influencing assistive technology adoption amongst all the participants. I was left with some unanswered questions, however, that

deserve to be systematically examined. For example, how often do parents actively advocate for the inclusion of assistive technology on their child's IEP? How often are they successful? How do each of the factors identified in this study impact the number of students on a teacher's case load who have assistive technology on their IEP? These questions could best be answered through additional quantitative research. Particular areas of interest to me include a correlational study on teacher technical ability (self rated) and the number of students with Assistive technology on their IEPs. A correlational study investigating teacher assistive technology preparation and professional development (measured in terms of classes/seminars) and the inclusion rate of assistive technology on their students' IEPs. Also, a correlational study on district support in the form of assistive technology lending libraries and number of students with assistive technology on their IEPs. These studies could help understand the magnitude of the impact each of these factors has on the adoption of assistive technology.

### *Implications for Practice*

Using the perspective of transferability (Lincoln & Guba, 1985), I believe the results of this study may have implications for creating a new emphasis on assistive technology in teacher preparation programs and teacher professional development. Beyond teacher preparation and development, the results of this study also suggest a new framework for how schools fund and support assistive technology in their special education programs. Each of these is discussed below.

### *Teacher Preparation*

One way to address 2 of the factors identified in this study (teacher's comfort with technology and teacher's awareness of assistive technology solutions) is to rethink teacher preparation programs. In reviewing the technology requirements of special education licensure programs at the 16 colleges and universities in the state of Minnesota that offer special education licensure programs (Table 3), several things became apparent.

Table 3

<b>College/University</b>	<b>Assistive Technology Courses/Certificates</b>	<b>Required Technology Course(s)</b>	<b>Elective Technology Course(s)</b>
Augsburg	None	<b>EDC 220</b> – Educational Technology	<b>EDC 220</b> – Educational Technology
Bemidji State	None	None	None
Bethel University	None	None	None
Capella University	None	<b>EDT 5233</b> Digital Citizenship and Technology Applications	None
Concordia University St. Paul	None	None	None
Hamline University	<b>SPED 7296</b> Assistive Technology	None required	<b>SPED 7296</b> Assistive Technology (ASD, OHD, TBI Certificate)
Martin Luther College	None	<b>EDT 3002</b> Teaching with Technology	<b>EDT 3002</b> Teaching with Technology
Minnesota State University - Mankato	None	None	None
Minnesota State University - Moorhead	None	None	None
Southwest Minnesota State University	None	None	None

St. Cloud State University	<b>SPED 415</b> Assistive Technology for Students with Special Needs (LD or EBD licensure option only) <b>SPED 414</b> Assistive Technology for Students with DD (DD licensure option only) <b>CDS 466</b> Augmentative and Alternative Communication (DD licensure option only)	<b>SPED 415</b> Assistive Technology for Students with Special Needs (LD or EBD licensure option only) <b>OR</b> <b>SPED 414</b> Assistive Technology for Students with DD (DD licensure option only) <b>AND</b> <b>CDS 466</b> Augmentative and Alternative Communication (DD licensure option only)	<b>SPED 415</b> Assistive Technology for Students with Special Needs (LD or EBD licensure option only) <b>SPED 414</b> Assistive Technology for Students with DD (DD licensure option only) <b>CDS 466</b> Augmentative and Alternative Communication (DD licensure option only)
St. Mary's University	<b>EDSE634</b> Assistive Technology, Instruction, & Interventions	<b>EDUC534</b> Technology in the Classroom: 5-12	<b>EDSE634</b> Assistive Technology, Instruction, & Interventions  <b>EDUC534</b> Technology in the Classroom: 5-12
St. Thomas University	<b>SPED 751</b> Positioning and Handling and Augmentative Communication Strategies	(DD, ECSE, ) <b>SPED 751</b> Positioning and Handling and Augmentative Communication Strategies	<b>CI 551</b> Use of Technology for Instruction
University of Minnesota	<b>EPSY 5631</b> – Introduction to Augmentative and Alternative Communication	None	<b>CI 5307</b> – Technology for Teaching and Learning
University of	None	None	<b>EDUC 3412</b> -

Minnesota – Duluth			The Computer in Education <b>EDUC 5412 -</b> The Computer in Education <b>EDUC 5413</b> Teaching With Technology -
Winona State University	None	None	None

First, only 5 of the 16 special education licensure programs require a course in assistive technology. Of those that did require a class in assistive technology, two of them were focused on augmentative and alternative communication systems, which is a narrowly focused subset of assistive technology. Further, only 7 of the 16 programs require a technology course of *any* kind. This means that at the vast majority of special education teacher licensure programs in Minnesota are not required to have any knowledge of assistive technology whatsoever. Worse, they are not even required to have any knowledge of educational technology in general.

Beyond requirements, fully half (8) of the 16 programs do not offer educational technology or assistive technology courses *at all*. Not only are these programs failing to require special education teachers to be knowledgeable in assistive technology, they are not giving their teacher candidates the option of learning more about educational technology *or* assistive technology.

Knowing that a teacher's comfort with technology in general and their awareness of assistive technology solutions are major determining factors in whether a teacher recommends assistive technology to their students, it is apparent that our teacher

preparation contribute to the under utilization of assistive technology, especially for children with cognitive impairments. It is the recommendation of this study that colleges and universities expand their licensure programs to include instruction in the effective use of assistive technology. Further, in order to foster this change, it may be necessary to change licensing requirements for special education teachers in the state of Minnesota.

#### *School and district support*

School and district support can help mitigate knowledge and comfort gaps that may exist among special education teachers. The teacher's interviewed in this study expressed a great deal of reliance on this support when considering assistive technology services for a student's IEP. Some teachers were almost totally reliant on outside recommendations. Others were wary of recommending assistive technology because they knew they would have to provide the technical support necessary for the student to make use of this technology in class and at home. These teachers indicated that more support at the school or district level would make a difference in their likelihood of recommending assistive technology for their students.

Probably the best case for the effectiveness of increasing school and district support, as well as a model for what that support should look like, came from the home district of one of the teachers and one of the students in this study. In this district, and in this school in particular, the special education department had an assistive technology lending library. This library consists of a wide range of assistive technology devices that are available to any teacher and/or student to use on a trial basis in order to evaluate whether or not it is both appropriate and effective. Along with this library is an assistive



technology “librarian” who supports the technology, makes recommendations on items that may be appropriate, and keeps teachers up to date on the latest trends and advances in assistive technology. This level of access and support was not matched in any of the other districts included in this study. Interestingly, nearly half the special education students in this school had some form of assistive technology on their IEP, as opposed to a rate of approximately 15% amongst the teachers in this study from other districts. Clearly, at least in this study, the model this particular school is using is having a profound impact on the use of assistive technology.

This model has been shown to be effective elsewhere. It is similar to the model PACER Center uses for their Simon Technology Center. From PACER’s website:

The Simon Technology Center (STC) is dedicated to making the benefits of technology more accessible to children and adults with disabilities. Through a collaborated effort involving parents, professionals, and consumers, the STC can provide numerous services for your family, as well as resources and informative answers to your questions. Since 1987, the Simon Technology Center has helped many children and adults, with a variety of disabilities, use assistive technology to enhance learning, work and independence.

(PACER, 2016)

The Simon Technology Center has a lending library of its own, similar to the one examined in this study. PACER Center gives the following description of their lending library:

Which technology is right for you or your child? Find out at the Simon Technology Center Lending Library!

With more than 1,900 items, the Lending Library lets you try out and borrow some of the newest educational and disability-specific software and devices on the market including:

- Text-to-speech software for reading accessibility
- Speech-to-text software for improved written communication
- Universally designed toys for playtime accessibility and inclusion
- Communication devices for communication freedom
- Computer access adaptations for independence
- Talking calculators for improved independence with math

The Simon Technology Center Lending Library allows you to try assistive technology before making a purchase decision and is open to Minnesota residents. Families, educators, and consumers who become library members benefit from personalized assistance, convenient hours and services. As a member, you can:

- Receive personal assistance in selecting and checking out materials.
- Try out devices and software.
- Reserve, check-out, or renew items by phone, email or in person.
- Schedule quick pick-up during regular business hours or library open hours.
- Have items mailed to you for free if you live in Greater Minnesota.

(PACER, 2016)

The Simon Technology Center's lending library and related services have been extremely helpful to both parents and educators in enabling them to more fully take advantage of assistive technology for students with special needs. A quote from a parent (Jessica) on their website demonstrates this. "I am able to communicate easier with school teachers, aids, and therapists because of the knowledge I've gained from the library."

### *Funding*

In order to more to take full advantage of all the promise that assistive technology offers, there needs to be dedicated funding available specifically for assistive technology. This funding should come from both one time and long-term sources. One time funding (in the form of grants and appropriations/levies) can be used for setting up lending libraries and the infrastructure needed to support the use of assistive technology.

Long term funding is needed in three key areas. The first area is funding exclusively dedicated to assistive technology. This type of funding can provide incentive for teachers to include assistive technology on their students' IEPs without needing to worry about the extra cost. The second area needing funding is professional development for teachers. Since teacher comfort with and awareness of assistive technology is a primary factor in including assistive technology on their students' IEPs, increasing professional development around assistive technology would help address this potential barrier. Finally, funding for the ongoing maintenance and support of assistive technology lending libraries is critical to ensuring the success of these programs.

## REFERENCES

- Abner, G. H. & Lahm, E. A. (2002). Implementation of assistive technology with students who are visually impaired: Teachers' readiness. *Journal of Visual Impairment and Blindness*, 96, 98-105.
- Alper, S., & Raharinirina, S. (2006). Assistive Technology for Individuals with Disabilities: A Review and Synthesis of the Literature. *Journal of Special Education Technology*, 21(2), 47-64.
- Americans with Disabilities Act of 1990, P.L. 101-336, 42 U.S.C. § 12101 *et seq.*
- Arc, T. (1993). Assistive technology for people with mental retardation. The Arc National Headquarters.
- Ayres, K. M., & Langone, J. (2002). Acquisition and Generalization of Purchasing Skills Using a Video Enhanced Computer-Based Instructional Program. *Journal of Special Education Technology*, 17(4), 15-28.
- Ayres, K. M., & Langone, J. (2005). Intervention and Instruction with Video for Students with Autism: A Review of the Literature. *Education and Training in Developmental Disabilities*, 40(2), 183-196.
- Bailey, N. (2000). *Assistive technology, accommodations, and the Americans with disabilities act*. Retrieved from [http://www.ilr.cornell.edu/extension/files/download/Assistive\\_Tech.pdf](http://www.ilr.cornell.edu/extension/files/download/Assistive_Tech.pdf)
- Bailey, M. N., Meidenbauer, N., Fein, J., & Mollica, B.M. (2005). Comprehensive statewide programs of technology-related assistance. In D. Edybum, K. Higgins, & R. Boone (Eds.) *Handbook of special education technology research and practice* (pp. 31-46). Whitefish Bay, WI: Knowledge by Design.

- Bartlett, L. D., Etscheidt, S., & Weisentstein, G. R. (2007). *Special education law and practice in public schools*. Upper Saddle River, NJ: Pearson Education
- Bausch, M. E. & Ault, M. J. (2008) Assistive technology implementation plan: A tool for improving outcomes. *Teaching Exceptional Children*, 41(1 ), 6-14.
- Bausch, M. E., Ault, M. J., Evmenova, A. S., & Behrmann, M. M. (2008). Going beyond AT devices: Are AT services being considered? *Journal of Special Education Technology*, 23( 2), 1-16.
- Bausch, M. E., Ault, M. J., & Hasselbring, T. S. (2006). *Assistive Technology Planner. From IEP Consideration to Classroom Implementation*. Lexington, KY: National Assistive Technology Research Institute.
- Bausch, M. E. & Hasselbring, T. (2004). Assistive technology: Are the necessary skills and knowledge being developed at the preservice and inservice levels? *Teacher Education and Special Education*, 27(2), 97-104.
- Bausch, M. E., Mittler, J. E., Hasselbring, T. S. & Cross, D. P. (2005). The assistive technology act of 2004: What does it say and what does it mean? *Physical Disabilities: Education and Related Services*, 23, 59-67.
- Beard, L. A., Carpenter, L. A., & Johnston, L. B. (2011). *Assistive technology access for all students* (2nd ed.). Upper Saddle River, NJ: Pearson Education.
- Behrmann, M. & Jerome, M. K. (2002). *Assistive technology for students with mild disabilities: Update 2002*. (ERIC Document Reproduction Service No. EDO-EC-02-01) Retrieved from [http://permanent.access.gpo.gov/websites/eric.ed.gov/ERIC\\_Digests/ed463595.htm](http://permanent.access.gpo.gov/websites/eric.ed.gov/ERIC_Digests/ed463595.htm)

- Beigel, A. (2000). Assistive technology assessment: More than the device. *Intervention in School and Clinic, 35*(4), 237-243.
- Blackhurst, A. E. (1997). Perspectives on Technology in Special Education. *TEACHING Exceptional Children, 29*(5), 41-48.
- Blackhurst, A. E. (2005). Perspectives on Applications of Technology in the Field of Learning Disabilities. *Learning Disability Quarterly, 28*(2), 175.
- Blackhurst, A. E. (2005a). Historical perspectives about technology applications for people with disabilities. In D. Edyburn, K. Higgins, & R. Boone (Eds.), *Handbook of special education technology research and practice* (pp. 3-31). Whitefish Bay, WI: Knowledge by Design.
- Blackhurst, A. E., & Edyburn, D. L. (2000). A Brief History of Special Education Technology. *Special Education Technology Practice, 2*(1), 21-36.
- Boehner, J. (2004). *Assistive technology act of 2004: Putting technology into the hands of individuals with disabilities*. U.S. House of Representatives Education and Workforce Committee- Bill Summary; Retrieved from [http://archives.republicans.edlabor.house.gov/archive/issues/108th/education/at/billsummary .htm](http://archives.republicans.edlabor.house.gov/archive/issues/108th/education/at/billsummary.htm)
- Bryant, D. P., Bryant, B. R. & Raskind, M. H. (1998). Using assistive technology to enhance the skills of students with learning disabilities. *Intervention in School and Clinic, 34*(1), 53-58.

- Bryant, B. R. & Seay, P. C. (1998). The technology-related assistance to individuals with disabilities act: Relevance to individuals with learning disabilities and their advocates. *Journal of Learning Disabilities*, 31(1), 4-15.
- Campbell, P. H. (2004). Participation-based services; promoting children's participation in natural settings. *Young Exceptional Children*, 8(1), 20 - 29.
- Campbell, P. H., McGregor, G., & Nacik, E. (1994). Promoting the development of young children through use of adaptive and assistive technology. In P. H. Stafford (Ed.), *Yearbook in early childhood education; Early childhood special education*. New York: Teachers College Press.
- Caverly, D. C. & Fitzgibbons, D. (2007). Techtalk: Assistive technology. *Journal of Developmental Education*, 31( 1), 38-39.
- Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage Publications.
- Cohen, J. (1988). *Statistical power analysisfor the behavioral sciences* (2nd ed.) Hillsdale, NJ: Lawrence Erlbaum Associates.
- Dalton, E.M. (2002). Assistive technology in education: A review of policies, standards, and curriculum integration from 1977 through 2000 involving assistive technology and the Individuals with Disabilities Education Act. *Issues in Teaching and Learning* v / [Online]. Rhode Island College: Providence, RI. Retrieved from <http://www2ric.edu/itl/vl/articles> dalton-php
- Day, S. L. & Edwards, B. J. (1996), Assistive technology for postsecondary students with learning disabilities. *Journal of Learning Disabilities*, 29( 5), 486-492, 503.

- Derer K., Polsgrove, L., & Rieth, H. (1996). A survey of assistive technology applications in schools and recommendations for practice. *Journal of Special Education Technology, 13*(2), 62-80.
- Dyal, A., Carpenter, L. B., & Wright, J. V. (2009). Assistive technology: What every school leader should know. *Education, 129*(30), 556-560.
- Dugan, L., Campbell, P., & Wilcox, M. (2006). Beliefs and decision-making about assistive technology in early intervention. *Topics in Early Childhood Special Education, 26*(1), 3 - 13.
- Edyburn, D. L. (2000a). Assistive technology and students with mild disabilities. *Focus on Exceptional Children, 32*(6), 1-24.
- Edyburn, D. (2003). Research and Practice: Measuring Assistive Technology Outcomes: Key Concepts. *Journal of Special Education Technology, 18*(1), 53-55.
- Flippo, K. F., Inge, K. J., & Barcus, J. M. (Eds.). (1995). *Assistive technology; A resource for school, work, and community*. Baltimore: Paul H. Brookes.
- Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory*. Chicago: Aldine.
- Hanline, M. F. (2010). Preservice teachers' perceptions of field experiences in inclusive preschool settings: Implications for personnel preparation. *Teacher Education and Special Education, 33*(4), 335-351.
- Hasselbring, R. S. & Glasser, C. H. (2000). Use of computer technology to help students with special needs. *Children and Computer Technology, 10*(2), 102-122.
- Hasselbring, T.S. & Bausch, M.A.(2005). Assistive technologies for reading. *Educational Leadership, 63*( 4), 72-75.



- Hutinger, P., Johanson, J., & Stoneburner, R. (1996). Assistive Technology Applications in Educational Programs of Children with Multiple Disabilities: A Case Study Report on the State of the Practice. *Journal of Special Education Technology*, 13(1), 16 - 35.
- Hutinger, P., Robinsosn, L., Schneider, C., & Johanson, J. (2002). *The Early Childhood Interactive Technology Literacy Curriculum Project: A Final Report*.
- Individuals with Disabilities Education Act Amendments of 1997, (1997).
- Jeffs, T., Behrmann, M., & Bannan-Ritland, B. (2006). Assistive Technology and Literacy Learning: Reflections of Parents and Children. *Journal of Special Education Technology*, 21(1), 37-44.
- Jeffs, T., & Morrison, W. F. (2005). Special Education Technology Addressing Diversity: A Synthesis of the Literature. *Journal of Special Education Technology*, 20(4), 19-25.
- Judge, S. & Simms, K. A. (2009). Assistive technology training at the preservice level. *Teacher Education and Special Education*, 32(1), 33-44.
- Korpela, R. A. , Siirtola, T. O. & Koivikko, M. J. (1992). The cost of assistive devices for children with multiple limitations. *Pediatrics*, 90( 4), 597-602.
- Lahm, E. A., & Sizemore, L. (2002). Factors that Influence Assistive Technology Decision Making. *Journal of Special Education Technology*, 17(1), 15-26.
- Langone, J. (1998). Managing Inclusive Instructional Settings: Technology, Cooperative Planning, and Team-Based Organization. *Focus on Exceptional Children*, 30(8), 1-15.

- Langone, J., Clees, T. J., Rieber, L., & Matzko, M. (2003). The Future of Computer-Based Interactive Technology for Teaching Individuals with Moderate to Severe Disabilities: Issues Relating to Research and Practice. *Journal of Special Education Technology, 18*(1), 5-16.
- Langone, J., & et al. (1996). The Differential Effects of a Typing Tutor and Microcomputer-Based Word Processing on the Writing Samples of Elementary Students with Behavior Disorders. *Journal of Research on Computing in Education, 29*(2), 141-158.
- Langone, J., Malone, D. M., & Kinsley, T. (1999). Technology solutions for young children with developmental concerns. *Infants and Young Children, 11*(4), 65-78.
- Langone, J., & Mechling, L. (2000). The Effects of a Computer-Based Instructional Program with Video Anchors on the Use of Photographs for Prompting Augmentative Communication. *Education and Training in Mental Retardation and Developmental Disabilities, 35*(1), 90-105.
- Langone, J., Shade, J., Clees, T. J., & Day, T. (1999). Effects of Multimedia Instruction on Teaching Functional Discrimination Skills to Students with Moderate/Severe Intellectual Disabilities. *International Journal of Disability, Development and Education, 46*(4), 493-513.
- Lee, Y. & Vega, L. A. (2005). Perceived knowledge, attitudes, and challenges of AT use in special education. *Journal of Special Education Technology, 20*(2), 60-64.
- Lewis, R. B. (1998). Assistive Technology and Learning Disabilities: Today's Realities and Tomorrow's Promises. *Journal of Learning Disabilities, 31*(1), 16-26,54.

- Lincoln, Y., & Guba, E. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage.
- Lode, C. (1992). How technology assists my daughter to compete in the mainstream of life. *Exceptional Parent*, 22(8), 34, 41.
- Marino, M. T., Marino, E. C., & Shaw, S. F. (2006). Making informed assistive technology decisions for students with high incidence disabilities. *Teaching Exceptional Children*, 38(6), 18-25.
- Maushak, N. J., Kelley, P. & Blodgett, T. (2001). Preparing teachers for the inclusive classroom: A preliminary study of attitudes and knowledge of assistive technology. *Journal of Technology and Teacher Education*, 9( 3), 419-431.
- Mechling, L. C., & Gast, D. L. (2003). Multi-Media Instruction To Teach Grocery Word Associations and Store Location: A Study of Generalization. *Education and Training in Mental Retardation and Developmental Disabilities*, 38(1), 62-76.
- Mechling, L. C., Gast, D. L., & Langone, J. (2002). Computer-Based Video Instruction To Teach Persons with Moderate Intellectual Disabilities To Read Grocery Aisle Signs and Locate Items. *Journal of Special Education*, 35(4), 224-240.
- Merbler, J. B., Hadadian, A., & Ulman, J. (1999). Using assistive technology in the inclusive classroom. *Preventing School Failure*, 43(3 ), 113-117.
- Michaels, C. A. & McDermott, J. (2003). Assistive technology integration in special education teacher preparation: Program coordinators' perceptions of current attainment and importance. *Journal of Special Education Technology*, 18( 3), 29-41.

- Mistrett, S. (2004). Assistive technology helps young children with disabilities participate in daily activities. *Technology in Action*, 1(4), 1-8.
- Mittler, J. (2007). Assistive technology and IDEA: Regulations. In C. Warger (Ed.), *Technology integration: Providing access to the curriculum for students with disabilities*. Arlington, VA: Technology and Media Division (TAM).
- Mondak, P. (2000). The Americans with disabilities act and information technology access. *Focus on Autism and Other Developmental Disabilities*, 15(1), 43-51.
- Nelson, B. (2006). On your mark, get set, wait! Are your teacher candidates prepared to embed assistive technology in teaching and learning? *College Student Journal* 40(3), 485-494.
- Nikopoulos, C. K., & Keenan, M. (2004). Effects of Video Modeling on Social Initiations by Children with Autism. *Journal of Applied Behavior Analysis*, 37(1), 93.
- Noble, L. (2002) Federal assistive technology legislation 1988-present. *The Exceptional Parent*, 32(6), 50-53.
- PACER Simon Technology Center. Retrieved from <http://www.pacer.org/stc/library/>
- Parette, H. P., Jr., & Murdick, N. L. (1998). Assistive Technology and IEPs for Young Children with Disabilities. *Early Childhood Education Journal*, 25(3), 193-198.
- Parette, H. P. & Peterson-Karlan, G. R. (2007). Facilitating student achievement with assistive technology. *Education and Training in Developmental Disabilities*, 42(4), 387-397.

- Parette, H. P. & Stoner, J. B. (2008). Benefits of assistive technology user groups for early childhood education professionals. *Early Childhood Education Journal*, 35, 313-319.
- Parette, H. P. & VanBiervliet, A. (1991). Rehabilitation assistive technology issues for infants and young children with disabilities: A preliminary examination. *The Journal of Rehabilitation*, 57(3), 27-37.
- Puckett, K. S. (2004). Project ACCESS: Field testing an assistive technology toolkit for students with mild disabilities. *Journal of Special Education Technology*, 19(2), 5-17.
- Raskind, M. H., Higgins, E. L., Slaff, N. B., & Shaw, T. K. (1998). Assistive Technology in the Homes of Children with Learning Disabilities: An Exploratory Study. *Learning Disabilities: A Multidisciplinary Journal*, 9(2), 47-56.
- Scott, M.M. & Hatfield, J.G. (1985). Problems of analyst and observer agreement in naturalistic narrative data. *Journal of Educational Measurement*, 22 (3), 207-218.
- Smith, T.E.C. (2001). Section 508, the ADA, and public schools. *Remedial and Special Education*, 22(6), 335-343. Retrieved from <http://www.ldonline.org/article/6108>
- Stead, J. (2009). Toward true equality of educational opportunity: Unlocking the potential of assistive technology through professional development. *Rutgers Computer and Technology Law Journal*, 35(2), 224-254.
- Stake, R.E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage Publications.

- Strauss, A. & Corbin, J. (1990). Basics of qualitative research: Grounded theory procedures and techniques. Newbury Park, CA: Sage Publications.
- Technology-Related Assistance for Individuals with Disabilities Act of 1988, P. L. 100-407, 29 U.S.C. § 2201 *et seq.*
- Technology-Related Assistance for Individuals with Disabilities Act of 1994, P. L. 103-218, 29 U.S.C. § 2201 *et seq.*
- Technology-Related Assistance for Individuals with Disabilities Act of 1998, P. L. 105-394, 29 U.S.C. § 2201 *et seq.*
- Technology-Related Assistance for Individuals with Disabilities Act of 2004, P. L. 108-364, 29 U.S.C. § 2201 *et seq.*
- Thompson, J., Siegel, J., & Kouzoukas, S. (2000). Assistive technology on the eve of the 21st century: Teacher perceptions. *Special Education Technology Practice*, 2( 3), 12-21.
- Todis, B. (1996). Tools for the Task? Perspectives on Assistive Technology in Educational Settings. *Journal of Special Education Technology*, 13(2), 49-61.
- Todis, B., & Walker, H. (1993). User perspectives on assistive technology in educational settings. *Focus on Exceptional Children*, 26, 1-16.
- U.S. Department of Education Institute of Education Sciences, National Center for Education Statistics (n.d.). *School District Profile*. Retrieved September 30, 2016 from <http://nces.ed.gov/surveys/sdds/singlechoicepage.asp?state1=27>
- Van Laarhoven, T., Munk, D. D., Zurita, L. M, Lynch, K., Zurita, B., Smith, T. & Chandler, L. (2008). The effectiveness of video tutorials for teaching preservice

- educators to use assistive technology. *Journal of Special & Education Technology*, 23(4), 31-45.
- Watts, E. H., O'Brian, M., & Wojcik, B. W. (2004). Four Models of Assistive Technology Consideration: How Do They Compare to Recommended Educational Assessment Practices? *Journal of Special Education Technology*, 19(1), 43-56.
- Wehmeyer, M. L. (1995). The use of assistive technology by people with mental retardation and barriers to this outcome: A pilot study. *Technology and Disability*, 4, 195-204.
- Wehmeyer, M. L. (1999). Assistive technology and students with mental retardation: Utilization and barriers. *Journal of Special & Education Technology*, 14(1), 48-58.
- Wilcox, M., Guimond, A., Campbell, P., & Moore, H. W. (2006). Assistive technology for infants and toddlers with disabilities; Provider perspectives regarding use, decision making practices, and resources. *Topics in Early Childhood Special Education*, 26(1), 33-49.
- Wissick, C. (2002). Evaluating a Text for a Special Education Technology Course. *Journal of Special Education Technology*, 17(1), 49-56.
- Wissick, C. A., Gardner, J. E., & Langone, J. (1999). Video-Based Simulations: Considerations for Teaching Students with Developmental Disabilities. *Career Development for Exceptional Individuals*, 22(2), 233-249.

- Yell, M. L. & Katsiyannis, A. (2004). Placing students with disabilities in inclusive settings: Legal guidelines and preferred practices. *Preventing School Failure*, 49(1), 28-35.
- Xu, C., Reid, R., & Steckelberg, A. (2002). Technology Applications for Children with ADHD: Assessing the Empirical Support. *Education and Treatment of Children*, 25(2), 224-248.



## APPENDIX A. INTERVIEW PROTOCOL: PARENTS

### **Opening comments:**

The purpose of this research study is to explore how parents of children with disabilities view assistive technology. You were selected as a possible participant because you have a child with a disability and an IEP in your school district. The interview will take about an hour. I am interested in exploring both what you know and don't know about assistive technology, and what you think of assistive technology, both for other children and for your own child.

### **Interview questions**

1. Tell me about your child.
  - a. Probe: What are his/her strengths?
  - b. Probe: What are his/her special challenges?
  - c. Probe: What are some of his/her struggles in school?
2. What types of resources do you have to help with his/her challenges and struggles
3. Tell me what you think assistive technology is.
  - a. Probe: Have you ever heard the term before?
4. How do you think assistive technology could help your child?
  - a. Probe: Do you think assistive technology is appropriate for your child?
  - b. How do you think assistive technology could help your child be successful in school?
5. Who would you talk to if you had questions about assistive technology? nice
  - a. Probe: Why?

6. Have you ever talked to someone from school, or has anyone from school ever talked to you about including assistive technology in your child's IEP
7. How do you currently use technology (any kind of technology) in your home?
8. How about at work?
9. Talk about some things that would prevent you from using assistive technology.
  - a. Probe: How would you overcome that?
10. If the school wanted to include some educational software in your child's IEP to help them overcome their learning disability, how would you react?
  - a. Probe: What would you be feeling?
  - b. Probe: How would you respond to them?
11. How would you react if they told you that you needed to include this educational software at home as part of your child's regular homework?
12. Do you have any other thoughts, feelings, or questions about assistive technology that you would like to share?

## APPENDIX B. INTERVIEW PROTOCOL: SPECIAL EDUCATION TEACHERS

### **Opening comments:**

The purpose of this research study is to explore how special education teachers view assistive technology. You were selected as a possible participant because you are a special education teacher in your school district. The interview will take about an hour. I am interested in exploring both what you know and don't know about assistive technology, and what you think of assistive technology both for your students.

### **Interview questions**

1. Tell me what you think assistive technology is.
  - a. Probe: Have you ever heard the term before?
2. How do you think assistive technology could help your students?
  - a. Probe: Do you think assistive technology is appropriate for your child?
3. How do you think assistive technology could help your students be successful in school?
4. Who would you talk to if you had questions about assistive technology?
  - a. Probe: Why?
5. Have you ever discussed including assistive technology in a child's IEP with a parent?
  - a. Probe: What factors influence your decision to discuss assistive technology with a parent?
  - b. How do parents react when you discuss assistive technology?
6. How do you currently use technology (any kind of technology) in your work?

7. Talk about some things that would prevent you from using assistive technology.
  - a. Probe: How would you overcome that?
8. Do you have any other thoughts, feelings, or questions about assistive technology that you would like to share?

## APPENDIX C. ASSISTIVE TECHNOLOGY LEGISLATION

- 1988 Technology Related Assistance for Individuals with Disabilities Act of  
1988 <https://www.gpo.gov/fdsys/pkg/STATUTE-102/pdf/STATUTE-102-Pg1044.pdf>
- 1990 Americans with Disabilities Act 1990  
<https://www.ada.gov/archive/adastat91.htm>  
EAHC/IDEA 1990  
<https://www.gpo.gov/fdsys/pkg/USCODE-2010-title20/pdf/USCODE-2010-title20-chap33-subchapI.pdf>
- 1994 Technology Related Assistance for Individuals with Disabilities Act  
Amendments of 1994  
<https://www.gpo.gov/fdsys/pkg/STATUTE-108/pdf/STATUTE-108-Pg50.pdf>
- 1997 IDEA Amendments of 1997  
<https://www.congress.gov/bill/105th-congress/house-bill/5/text>
- 1998 Amendment to Section 508  
[http://www.edd.ca.gov/jobs\\_and\\_training/pubs/wialaw.pdf](http://www.edd.ca.gov/jobs_and_training/pubs/wialaw.pdf)  
Assistive Technology Act of 1998  
<https://www.gpo.gov/fdsys/pkg/PLAW-105publ394/html/PLAW-105publ394.htm>

2004      Assistive Technology Act of 2004

<https://www.gpo.gov/fdsys/pkg/STATUTE-118/pdf/STATUTE-118-Pg1707.pdf>

Individuals with Disabilities Education Improvement Act (IDEA 2004)

<https://www.gpo.gov/fdsys/pkg/PLAW-108publ446/html/PLAW-108publ446.htm>